ASTRONOMICAL PHENOMENA

FOR THE YEAR

1991

Prepared Jointly by
The Nautical Almanac Office
United States Naval Observatory
and
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Royal Greenwich Observatory

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INTRODUCTORY NOTE

The astronomical data in this booklet are expressed in the scale of universal time (UT); this is also known as Greenwich mean time (GMT) and is the standard time of the Greenwich meridian (0° of longitude). A time in UT may be converted to local mean time by the addition of east longitude (or subtraction of west longitude), where the longitude of the place is expressed in time-measure at the rate of 1 hour for every 15°. The differences between standard times and UT are indicated in the chart on page 22; local clock times may, however, differ from these standard times, especially in summer when clocks are often advanced by 1 hour.

PRINCIPAL PHENOMENA OF SUN AND MOON, 1991

THE SUN

		d h			d h m		d h m
Perigee	... Jan.	3 03	Equinoxes	... Mar.	21 03 02 ...	... Sept.	23 12 48
Apogee	... July	6 15	Solstices	... June	21 21 19 ...	... Dec.	22 08 54

PHASES OF THE MOON

Lunation	New Moon	First Quarter	Full Moon	Last Quarter
	d h m	d h m	d h m	d h m
841				Jan. 7 18 35
842	Jan. 15 23 50	Jan. 23 14 21	Jan. 30 06 10	Feb. 6 13 52
843	Feb. 14 17 32	Feb. 21 22 58	Feb. 28 18 25	Mar. 8 10 32
844	Mar. 16 08 10	Mar. 23 06 03	Mar. 30 07 17	Apr. 7 06 45
845	Apr. 14 19 38	Apr. 21 12 39	Apr. 28 20 58	May 7 00 46
846	May 14 04 36	May 20 19 46	May 28 11 37	June 5 15 30
847	June 12 12 06	June 19 04 19	June 27 02 58	July 5 02 50
848	July 11 19 06	July 18 15 11	July 26 18 24	Aug. 3 11 25
849	Aug. 10 02 28	Aug. 17 05 01	Aug. 25 09 07	Sept. 1 18 16
850	Sept. 8 11 01	Sept. 15 22 01	Sept. 23 22 40	Oct. 1 00 30
851	Oct. 7 21 39	Oct. 15 17 33	Oct. 23 11 08	Oct. 30 07 10
852	Nov. 6 11 11	Nov. 14 14 02	Nov. 21 22 56	Nov. 28 15 21
853	Dec. 6 03 56	Dec. 14 09 32	Dec. 21 10 23	Dec. 28 01 55

ECLIPSES

Annular eclipse of the Sun	Jan. 15–16	E. of Indonesia, S. of New Guinea, Australia, New Zealand, part of Antarctica, Polynesia
Penumbral eclipse of the Moon	Jan. 30	
Penumbral eclipse of the Moon	June 27	
Total eclipse of the Sun	July 11	Hawaiian Islands, S.W. of Canada, U.S.A. except extreme N.E., Mexico, Central and S. America except extreme S.
Penumbral eclipse of the Moon	July 26	
Partial eclipse of the Moon	Dec. 21	Iceland, Greenland, arctic regions. N.W. of S. America, Central America, N. America, Pacific Ocean, Australasia except extreme W., Asia except S.W., extreme N. Europe

For further details see page 64.

MOON AT PERIGEE

	d h		d h		d h
Jan.	28 09	June	13 00	Oct.	27 16
Feb.	25 01	July	11 10	Nov.	24 02
Mar.	22 05	Aug.	8 18	Dec.	22 09
Apr.	17 17	Sept.	5 19		
May	15 17	Oct.	2 18		

MOON AT APOGEE

	d h		d h		d h
Jan.	12 11	May	31 03	Oct.	15 11
Feb.	9 04	June	27 07	Nov.	12 08
Mar.	9 01	July	24 11	Dec.	10 02
Apr.	5 21	Aug.	20 23		
May	3 15	Sept.	17 15		

OCCULTATIONS OF PLANETS AND BRIGHT STARS BY THE MOON

Date		Body	Areas of Visibility
	d h		
Jan.	12 03	*Antares*	Middle East, S. central Asia, India, S.E. Asia, China, Philippines
Feb.	8 11	*Antares*	S.E. of N. America, Cuba, West Indies, N. tip of S. America, N. Atlantic, W. Africa
Feb.	11 04	Uranus	S. Pacific, Ross Dependency Antarctica
Feb.	12 18	Saturn	Central Pacific, Hawaii, Mexico, central America, S. and E. of N. America, West Indies, Cuba
Mar.	7 19	*Antares*	Korea, Japan, N.E. of U.S.S.R., N. Pacific, Aleutian Is., Midway I.
Mar.	10 15	Uranus	S. Pacific, Antarctica, Falkland Islands, S. Atlantic
Mar.	12 08	Saturn	N. Africa, Europe except the extreme N., British Isles, Turkey, S.W. of U.S.S.R.
Mar.	22 17	Mars	N. Atlantic, N.E. Canada, Greenland, Iceland, British Isles, Scandinavia, N. Europe, U.S.S.R. except E.
Apr.	4 03	*Antares*	British Isles, central and S. Europe except extreme S.W., W. of U.S.S.R., W. Turkey
Apr.	7 00	Uranus	Southern Ocean, Antarctica, Australia except N.W., S. of New Zealand
Apr.	20 00	Mars	S. Pacific, Tahiti, Marquesas, S.W. of S. America
May	4 08	Uranus	S. Pacific, S. of S. America, Falkland Is., S. Atlantic
May	31 13	Uranus	Australia except the extreme N. and W., New Zealand, Tahiti, Marquesas, S. Pacific
May	31 20	Neptune	Ross Dependency Antarctica, S. Pacific
June	27 17	Uranus	S. Madagascar, S. Indian Ocean, Australia, E. New Guinea, New Caledonia
June	28 00	Neptune	Australian Antarctic Territory
July	24·21	Uranus	S. Atlantic, S. of S. Africa, Madagascar except extreme N., Indian Ocean
Aug.	11 08	Mercury	Central Europe, Scandinavia, W. and central U.S.S.R., N. India, China, S.E. Asia, Philippines, N. Borneo
Aug.	21 02	Uranus	S. Pacific, S. of S. America, Falkland Is., E. coast of S. America, S. Atlantic
Sept.	17 09	Uranus	Indian Ocean, S. Australia, New Zealand, New Caledonia, Fiji, S. Pacific
Sept.	17 17	Neptune	Southern Ocean (S. of Australia), coast of Antarctica
Oct.	4 15	Venus	Pacific, Hawaii, W. coast of Mexico, central S. America
Oct.	14 18	Uranus	Central and N. of S. America except extreme N., S. Atlantic, central Africa
Oct.	15 02	Neptune	Pacific (S. of New Zealand), coast of Antarctica, S. of S. America, Falkland Is.
Nov.	8 05	Mercury	Indian Ocean, Southern Ocean, Antarctica, S. tip of New Zealand
Nov.	11 03	Uranus	N. Guinea, extreme N. of Australia, central Pacific, Hawaii
Nov.	11 11	Neptune	S. of S. Africa, Southern Ocean, N. Australian Antarctic Territory, Australia except E., Timor
Dec.	8 14	Uranus	W. and N. Africa, Europe except N.W., W. of U.S.S.R., Middle East except S. Saudi Arabia
Dec.	8 20	Neptune	S. Pacific, central and S. of S. America except extreme S.

GEOCENTRIC PHENOMENA

MERCURY

		d h		d h		d h		d h	
Stationary	Jan.	3 19		Apr.	27 06	Aug.	30 20	Dec.	18 12
Greatest elongation West	Jan.	14 09	(24°)	May	12 18	(26°)	Sept. 7 18	(18°)	Dec. 27 21 (22°)
Superior conjunction ...	Mar.	2 03		June	17 05		Oct. 3 17		
Greatest elongation East	Mar.	27 15	(19°)	July	25 02	(27°)	Nov. 19 02	(22°)	
Stationary	Apr.	4 17		Aug.	7 04		Nov. 28 18		
Inferior conjunction ...	Apr.	14 21		Aug.	21 21		Dec. 8 15		

VENUS

		d h			d h	
Greatest elongation East ...	June	13 22	(45°)	Stationary	Sept.	12 02
Greatest brilliancy ...	July	17 05		Greatest brilliancy ...	Sept.	28 23
Stationary	July	30 04		Greatest elongation West	Nov.	2 09 (47°)
Inferior conjunction ...	Aug.	22 20				

EARTH

		d h			d h m			d h m
Perihelion ...	Jan.	3 03	Equinoxes ...	Mar.	21 03 02	... ...	Sept.	23 12 48
Aphelion ...	July	6 15	Solstices ...	June	21 21 19	... ...	Dec.	22 08 54

SUPERIOR PLANETS

	Stationary		Opposition		Stationary		Conjunction	
	d	h	d	h	d	h	d	h
Mars	—		—		Jan. 1	16	Nov. 8	09
Jupiter	Dec. 31	12	Jan. 29	00	Mar. 30	14	Aug. 17	22
Saturn	May 17	11	July 27	00	Oct. 5	02	Jan. 18	08
Uranus	Apr. 18	12	July 4	07	Sept. 19	09	—	
Neptune	Apr. 18	23	July 8	00	Sept. 26	05	Jan. 5	03
Pluto	Feb. 25	14	May 10	03	Aug. 2	19	Nov. 13	04

HELIOCENTRIC PHENOMENA

	Aphelion	Perihelion	Greatest Lat. North	Descending Node	Greatest Lat. South	Ascending Node
Mercury	Feb. 3	Mar. 19	Jan. 1	Jan. 24	Feb. 24	Mar. 15
	May 2	June 15	Mar. 30	Apr. 22	May 23	June 11
	July 29	Sept. 11	June 26	July 19	Aug. 19	Sept. 7
	Oct. 25	Dec. 8	Sept. 22	Oct. 15	Nov. 15	Dec. 4
	—	—	Dec. 19	—	—	—
Venus	—	Apr. 21	May 12	July 7	Jan. 21	Mar. 18
	Aug. 11	Dec. 2	Dec. 23	—	Sept. 2	Oct. 29
Mars	June 9	—	May 2	Nov. 16	—	—

Jupiter, Saturn, Uranus, Neptune, Pluto: None in 1991

VISIBILITY OF PLANETS

MERCURY can only be seen low in the east before sunrise, or low in the west after sunset (about the time of the beginning or end of civil twilight). It is visible in the mornings between the following approximate dates: January 1 to February 18, April 23 to June 10, August 30 to September 23 and December 14 to December 31. The planet is brighter at the end of each period, (the best conditions in northern latitudes occur around the second week in September and, only in low northern latitudes, during the second and third weeks of January and the last 10 days of December, and in southern latitudes most of January and early February and from the end of April until the end of May). It is visible in the evenings between the following approximate dates: March 12 to April 6, June 25 to August 15 and October 18 to December 3. The planet is brighter at the end of each period, (the best conditions in northern latitudes occur during the last two weeks of March and in southern latitudes from early July until just before mid-August and late October to late November).

VENUS is a brilliant object in the evening sky from the beginning of the year until mid-August when it becomes too close to the Sun for observation. Towards the end of August it reappears in the morning sky where it stays until the end of the year. Venus is in conjunction with Saturn on January 1, with Jupiter on June 17 and October 17, with Mars on June 23 and July 22 and with Mercury on August 7 and 29.

MARS can be seen in January for more than half the night in Taurus, its eastward elongation gradually decreases (passing 8° N of *Aldebaran* on February 22) until it can only be seen in the evening sky passing from Taurus through Gemini (passing 5° S of *Pollux* on May 16), Cancer, Leo (passing 0.7° N of *Regulus* on July 14) and into Virgo where towards the end of September it becomes too close to the Sun for observation. It reappears in the morning sky in Ophiuchus in late December. Mars is in conjunction with Jupiter on June 14, with Venus on June 23 and July 22.

JUPITER can be seen for most of the night in Cancer, its westward elongation gradually increases until it is at opposition on January 29 when it can be seen throughout the night. Its eastward elongation then gradually decreases as it passes into Leo in mid-July where it can be seen only in the evening sky. In early August it becomes too close to the Sun for observation until the beginning of September when it reappears in the morning sky in Leo in which constellation it remains for the rest of the year (passing 0.4° N of *Regulus* on September 10). Its westward elongation gradually increases until by mid-December it can be seen for more than half the night. Jupiter is in conjunction with Mars on June 14, with Venus on June 17 and October 17 and with Mercury on July 15 and September 10.

SATURN can be seen on January 1 in the evening sky in Sagittarius then it becomes too close to the Sun for observation. It reappears in the morning sky in early February in Capricornus in which constellation it remains for the rest of the year. Its westward elongation gradually increases until it is at opposition on July 27 when it is visible throughout the night. Its eastward elongation then gradually decreases until from late October it can only be seen in the evening sky. Saturn is in conjunction with Venus on January 1 and with Mercury on February 5.

URANUS is too close to the Sun for observation until towards the end of January when it appears in the morning sky in Sagittarius, in which constellation it remains throughout the year. It is at opposition on July 4 when it can be seen throughout the night, after which its eastward elongation gradually decreases. From early October it can only be seen in the evening sky until the second half of December when it again becomes too close to the Sun for observation.

NEPTUNE is too close to the Sun for observation until late January when it can be seen in the morning sky shortly before sunrise in Sagittarius, in which constellation it remains throughout the year. It is at opposition on July 8 when it can be seen throughout the night. From mid-October it can only be seen in the evening sky until mid-December when it again becomes too close to the Sun for observation.

DO NOT CONFUSE (1) Venus with Saturn on January 1, with Mars from the second week in June until near the end of July, with Jupiter for the third and fourth weeks of June and again the second and third weeks of October and with Mercury from the end of July until mid-August; on all occasions Venus is the brighter object. (2) Mercury with Saturn around the end of the first week of February when Mercury is the brighter object. (3) Jupiter with Mars for most of June and with Mercury around mid-July and the first half of September; on all occasions Jupiter is the brighter object.

VISIBILITY OF PLANETS IN MORNING AND EVENING TWILIGHT

	MORNING	EVENING
VENUS	August 27 – December 31	January 1 – August 18
MARS	December 29 – December 31	January 1 – September 21
JUPITER	January 1 – January 29	January 29 – August 4
	September 1 – December 31	
SATURN	February 5 – July 27	January 1
		July 27 – December 31

VISIBILITY OF PLANETS

The planet diagram on page 9 shows, in graphical form for any date during the year, the local mean times of meridian passage of the Sun, of the five planets, Mercury, Venus, Mars, Jupiter and Saturn, and of every 2^h of right ascension. Intermediate lines, corresponding to particular stars, may be drawn in by the user if he so desires. The diagram is intended to provide a general picture of the availability of planets and stars for observation during the year.

On each side of the line marking the time of meridian passage of the Sun, a band 45^m wide is shaded to indicate that planets and most stars crossing the meridian within 45^m of the Sun are generally too close to the Sun for observation.

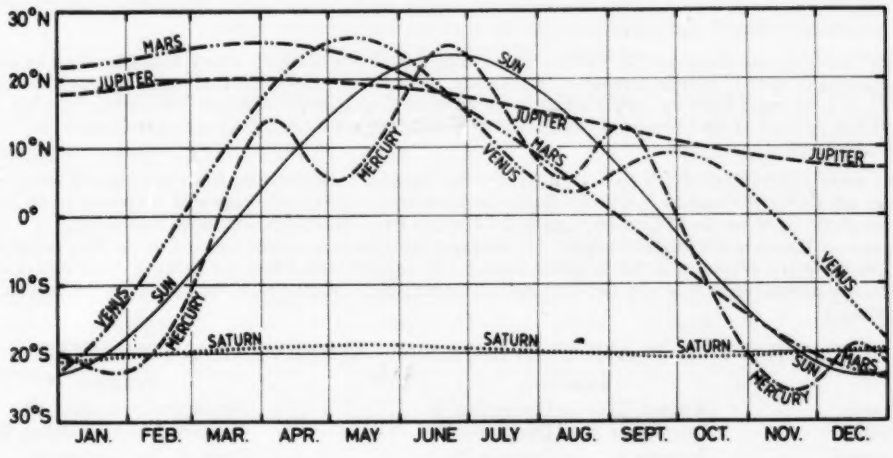
For any date the diagram provides immediately the local mean times of meridian passage of the Sun, planets and stars, and thus the following information:

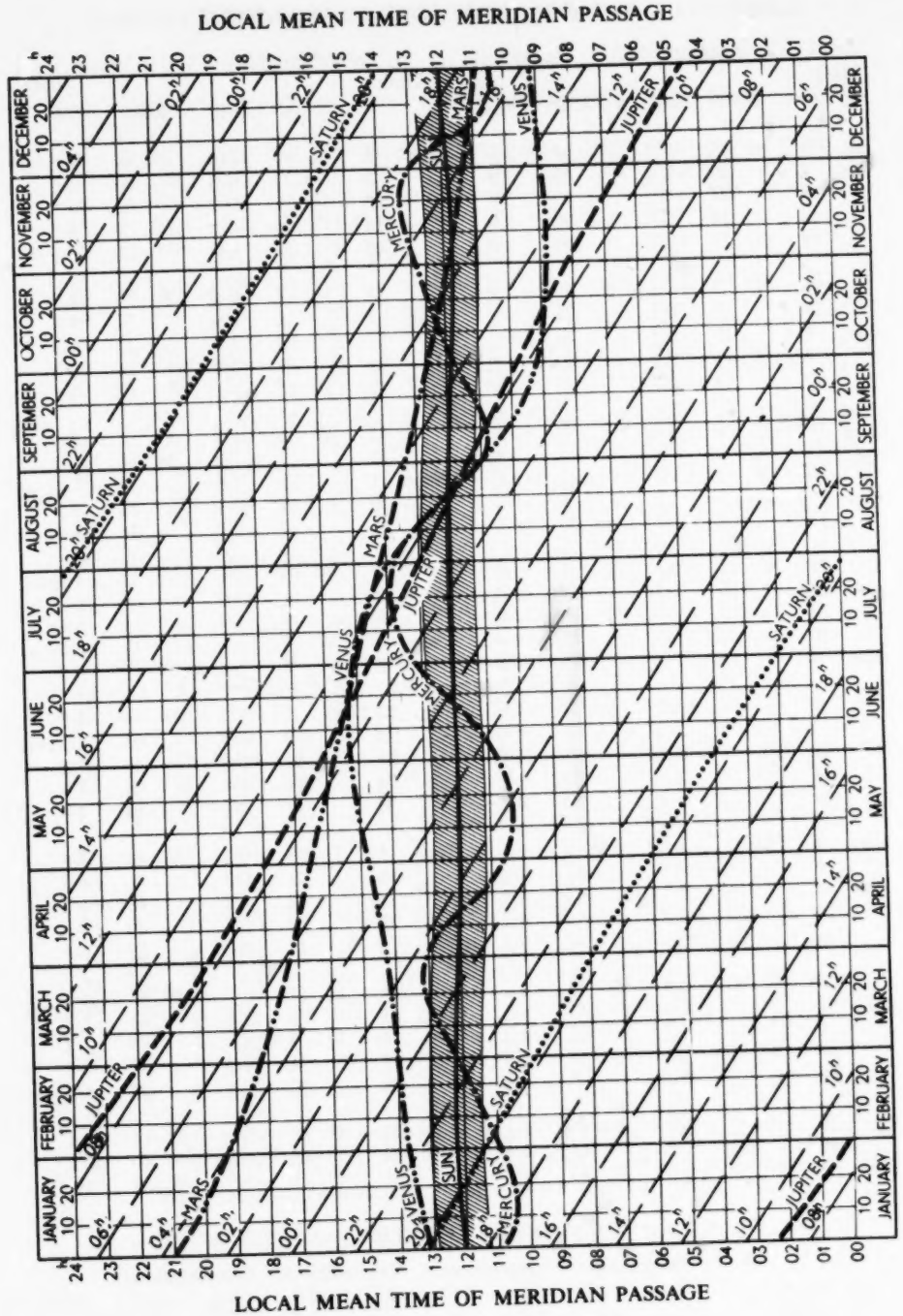
(a) whether a planet or star is too close to the Sun for observation;
(b) visibility of a planet or star in the morning or evening;
(c) location of a planet or star during twilight;
(d) proximity of planets to stars or other planets.

When the meridian passage of a body occurs at midnight, it is close to opposition to the Sun and is visible all night, and may be observed in both morning and evening twilights. As the time of meridian passage decreases, the body ceases to be observable in the morning, but its altitude above the eastern horizon during evening twilight gradually increases until it is on the meridian at evening twilight. From then onwards the body is observable above the western horizon, its altitude at evening twilight gradually decreasing, until it becomes too close to the Sun for observation. When it again becomes visible, it is seen in the morning twilight, low in the east. Its altitude at morning twilight gradually increases until meridian passage occurs at the time of morning twilight, then as the time of meridian passage decreases to 0^h, the body is observable in the west in the morning twilight with a gradually decreasing altitude, until it once again reaches opposition.

Notes on the visibility of the principal planets, except Pluto, are given on page 7. Further information on the visibility of planets may be obtained from the diagram below which shows, in graphical form for any date during the year, the declinations of the bodies plotted on the planet diagram on page 9.

DECLINATIONS OF SUN AND PLANETS, 1991




LOCAL MEAN TIME OF MERIDIAN PASSAGE
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
SATURN
MERCURY
MARS
VENUS
JUPITER
SUN
LOCAL MEAN TIME OF MERIDIAN PASSAGE

ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h UT

Date	Mercury		Venus	
	Elong.	Mag.	Elong.	Mag.
	°		°	
Jan. −1	W. 13	+1·7	E. 14	−3·9
4	20	+0·4	15	3·9
9	23	−0·1	17	3·9
14	24	0·2	18	3·9
19	23	0·2	19	3·9
24	W. 22	−0·2	E. 20	−3·9
29	20	0·2	21	3·9
Feb. 3	18	0·3	22	3·9
8	16	0·4	24	3·9
13	13	0·5	25	3·9
18	W. 10	−0·8	E. 26	−3·9
23	6	1·1	27	3·9
28	W. 3	1·5	28	4·0
Mar. 5	E. 3	1·7	29	4·0
10	7	1·5	30	4·0
15	E. 12	−1·3	E. 31	−4·0
20	16	1·0	32	4·0
25	18	−0·5	34	4·0
30	18	+0·4	35	4·0
Apr. 4	16	1·6	36	4·0
9	E. 10	+3·2	E. 37	−4·0
14	E. 3	5·4	38	4·0
19	W. 7	4·3	39	4·1
24	15	2·7	40	4·1
29	20	1·8	40	4·1
May 4	W. 24	+1·2	E. 41	−4·1
9	26	0·8	42	4·1
14	26	0·5	43	4·1
19	25	+0·2	44	4·2
24	23	−0·1	44	4·2
29	W. 20	−0·4	E. 45	−4·2
June 3	16	0·8	45	4·2
8	11	1·2	45	4·3
13	W. 5	1·8	45	4·3
18	E. 1	2·2	45	4·3
23	E. 7	−1·5	E. 45	−4·4
28	13	1·0	45	4·4
July 3	E. 17	−0·6	E. 44	−4·4

Date	Mercury		Venus	
	Elong.	Mag.	Elong.	Mag.
	°		°	
July 3	E. 17	−0·6	E. 44	−4·4
8	21	−0·3	43	4·4
13	24	0·0	41	4·5
18	26	+0·2	39	4·5
23	27	0·4	36	4·5
28	E. 27	+0·6	E. 33	−4·5
Aug. 2	25	0·9	28	4·4
7	22	1·4	23	4·3
12	17	2·2	18	4·2
17	E. 10	3·5	12	4·1
22	W. 4	+4·8	E. 8	−4·0
27	9	3·2	W. 11	4·0
Sept. 1	15	1·3	16	4·2
6	18	+0·1	22	4·3
11	17	−0·7	28	4·4
16	W. 15	−1·0	W. 32	−4·5
21	11	1·2	36	4·5
26	7	1·4	39	4·6
Oct. 1	W. 3	1·5	41	4·6
6	E. 2	1·4	43	4·5
11	E. 5	−1·0	W. 44	−4·5
16	9	0·7	45	4·5
21	11	0·5	46	4·5
26	14	0·4	46	4·4
31	17	0·3	46	4·4
Nov. 5	E. 19	−0·3	W. 46	−4·4
10	21	0·3	46	4·3
15	22	0·3	46	4·3
20	22	−0·3	46	4·3
25	21	0·0	45	4·3
30	E. 17	+0·7	W. 45	−4·2
Dec. 5	E. 8	2·8	44	4·2
10	W. 4	4·3	43	4·2
15	14	1·3	42	4·2
20	20	+0·1	42	4·1
25	W. 22	−0·2	W. 41	−4·1
30	22	0·3	40	4·1
35	W. 21	−0·3	W. 39	−4·1

MINOR PLANETS

	Stationary	Opposition	Stationary	Conjunction
Ceres ...	Mar. 3	Apr. 17	June 10	Dec. 11
Pallas ...	Jan. 23	Mar. 6	Apr. 10	Nov. 4
Juno ...	May 23	July 16	Sept. 6	—
Vesta ...	—	—	Jan. 5	July 9

ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h UT

Date	Mars		Jupiter		Saturn		Uranus	Neptune	Pluto
	Elong.	Mag.	Elong.	Mag.	Elong.	Mag.	Elong.	Elong.	Elong.
	°		°		°		°	°	°
Jan. 25	E. 145	−1·2	W. 140	−2·5	E. 22	+0·6	E. 6	E. 11	W. 46
4	135	0·9	151	2·5	13	0·6	W. 3	E. 1	55
14	125	0·6	163	2·6	E. 4	0·5	13	W. 9	64
24	117	−0·3	W. 174	2·6	W. 5	0·6	22	19	74
Feb. 3	110	0·0	E. 174	2·6	14	0·6	32	28	84
13	E. 103	+0·2	E. 163	−2·6	W. 23	+0·6	W. 42	W. 38	W. 93
23	97	0·4	152	2·5	32	0·7	51	48	103
Mar. 5	92	0·6	141	2·5	41	0·7	61	58	113
15	86	0·8	130	2·4	50	0·7	71	67	122
25	81	1·0	120	2·3	59	0·7	80	77	132
Apr. 4	E. 77	+1·1	E. 110	−2·3	W. 68	+0·7	W. 90	W. 87	W. 141
14	72	1·2	100	2·2	78	0·7	100	97	150
24	68	1·3	91	2·1	87	0·7	110	107	158
May 4	64	1·4	82	2·1	96	0·6	119	116	W. 163
14	60	1·5	74	2·0	106	0·6	129	126	E. 164
24	E. 56	+1·6	E. 65	−1·9	W. 116	+0·5	W. 139	W. 136	E. 159
June 3	52	1·6	57	1·9	125	0·5	149	146	152
13	49	1·7	49	1·9	135	0·4	159	155	144
23	45	1·7	42	1·8	145	0·3	169	165	135
July 3	42	1·8	34	1·8	155	0·3	W. 179	W. 175	126
13	E. 38	+1·8	E. 27	−1·8	W. 166	+0·2	E. 171	E. 175	E. 116
23	35	1·8	19	1·7	W. 176	0·1	161	165	107
Aug. 2	32	1·8	12	1·7	E. 174	0·1	152	155	98
12	28	1·8	E. 4	1·7	164	0·2	142	146	89
22	25	1·8	W. 3	1·7	153	0·2	132	136	80
Sept. 1	E. 22	+1·8	W. 11	−1·7	E. 143	+0·3	E. 122	E. 126	E. 71
11	19	1·7	18	1·7	133	0·3	112	116	61
21	15	1·7	26	1·8	123	0·4	102	106	52
Oct. 1	12	1·7	33	1·8	113	0·5	93	97	43
11	9	1·6	41	1·8	103	0·5	83	87	35
21	E. 6	+1·6	W. 49	−1·8	E. 93	+0·5	E. 73	E. 77	E. 26
31	E. 3	1·5	58	1·9	84	0·6	63	67	19
Nov. 10	W. 1	1·5	66	1·9	74	0·6	54	57	E. 15
20	4	1·5	75	2·0	65	0·6	44	48	W. 16
30	7	1·5	84	2·0	55	0·7	35	38	22
Dec. 10	W. 10	+1·5	W. 93	−2·1	E. 46	+0·7	E. 25	E. 28	W. 30
20	13	1·5	103	2·2	37	0·7	15	18	38
30	15	1·4	113	2·2	28	0·7	E. 6	E. 8	48
40	W. 18	+1·4	W. 123	−2·3	E. 19	+0·6	W. 4	W. 2	W. 57

Magnitudes at opposition: Uranus 5·6 Neptune 7·9 Pluto 13·7

VISUAL MAGNITUDES OF MINOR PLANETS

	Jan. 4	Feb. 13	Mar. 25	May 4	June 13	July 23	Sept. 1	Oct. 11	Nov. 20	Dec. 30
Ceres	8·6	8·1	7·3	7·2	8·0	8·6	9·0	9·0	8·8	8·8
Pallas	8·0	7·2	7·1	8·3	9·0	9·5	9·6	9·7	9·8	10·0
Juno	11·3	11·4	11·1	10·7	10·0	9·4	9·9	10·3	10·5	10·4
Vesta	7·4	8·0	8·3	8·4	8·3	8·1	8·3	8·2	7·9	7·4

CONFIGURATIONS OF SUN, MOON AND PLANETS

	d	h		
Jan.	1	15	Venus 1°·2 S. of Saturn	
	1	16	Mars stationary	
	2	23	Jupiter 2° N. of Moon	
	3	03	Earth at perihelion	
	3	19	Mercury stationary	
	5	03	Neptune in conjunction with Sun	
	5	08	Vesta stationary	
	7	19	LAST QUARTER	
	12	03	Antares 0°·6 S. of Moon	Occn.
	12	11	Moon at apogee	
	13	20	Mercury 4° N. of Moon	
	14	09	Mercury greatest elong. W. (24°)	
	16	00	NEW MOON	Eclipse
	17	18	Venus 3° S. of Moon	
	18	08	Saturn in conjunction with Sun	
	23	14	FIRST QUARTER	
	23	17	Mercury 0°·4 N. of Uranus	
	23	21	Pallas stationary	
	25	15	Mars 2° S. of Moon	
	26	14	Mercury 1°·1 S. of Neptune	
	28	09	Moon at perigee	
	29	00	Jupiter at opposition	
	30	05	Jupiter 1°·8 N. of Moon	
	30	06	FULL MOON	Penumbral Eclipse
Feb.	5	16	Mercury 1°·2 S. of Saturn	
	6	14	LAST QUARTER	
	8	11	Antares 0°·7 S. of Moon	Occn.
	9	04	Moon at apogee	
	11	04	Uranus 1°·1 N. of Moon	Occn.
	11	11	Neptune 1°·9 N. of Moon	
	12	18	Saturn 0°·5 S. of Moon	Occn.
	14	18	NEW MOON	
	17	02	Venus 6° S. of Moon	
	21	23	FIRST QUARTER	
	22	08	Mars 8° N. of Aldebaran	
	22	13	Mars 1°·6 S. of Moon	
	25	01	Moon at perigee	
	25	14	Pluto stationary	
	26	09	Jupiter 1°·6 N. of Moon	
	28	18	FULL MOON	
Mar.	2	03	Mercury in superior conjunction	
	3	23	Ceres stationary	
	6	08	Pallas at opposition	
	7	19	Antares 0°·8 S. of Moon	Occn.
	8	11	LAST QUARTER	
	9	01	Moon at apogee	
	10	15	Uranus 0°·9 N. of Moon	Occn.
	10	21	Neptune 1°·8 N. of Moon	
	12	08	Saturn 0°·9 S. of Moon	Occn.
	16	08	NEW MOON	
	17	15	Mercury 5° S. of Moon	
	19	00	Venus 5° S. of Moon	
	21	03	Equinox	
	22	05	Moon at perigee	
	22	17	Mars 0°·7 S. of Moon	Occn.
	23	06	FIRST QUARTER	
	25	13	Jupiter 1°·6 N. of Moon	
	27	15	Mercury greatest elong. E.(19°)	
	28	02	Pallas 0°·9 N. of Moon	Occn.
	30	07	FULL MOON	
	30	14	Jupiter stationary	
Apr.	4	03	Antares 1°·1 S. of Moon	Occn.
	4	17	Mercury stationary	
	5	21	Moon at apogee	
	7	00	Uranus 0°·6 N. of Moon	Occn.
	7	06	Neptune 1°·5 N. of Moon	
	7	07	LAST QUARTER	
	8	21	Saturn 1°·4 S. of Moon	
	10	00	Pallas stationary	
	14	20	NEW MOON	
	14	21	Mercury in inferior conjunction	
	17	16	Ceres at opposition	
	17	16	Venus 2° S. of Moon	
	17	17	Moon at perigee	
	18	12	Uranus stationary	
	18	23	Neptune stationary	
	20	00	Mars 0°·6 N. of Moon	Occn.
	21	13	FIRST QUARTER	
	21	19	Jupiter 1°·9 N. of Moon	
	22	04	Venus 7° N. of Aldebaran	
	27	06	Mercury stationary	
	28	21	FULL MOON	
May	3	15	Moon at apogee	
	4	08	Uranus 0°·3 N. of Moon	Occn.
	4	14	Neptune 1°·2 N. of Moon	
	6	07	Saturn 1°·8 S. of Moon	
	7	01	LAST QUARTER	
	10	03	Pluto at opposition	
	12	13	Mercury 9° S. of Moon	
	12	18	Mercury greatest elong. W.(26°)	
	14	05	NEW MOON	
	15	17	Moon at perigee	
	16	05	Mars 5° S. of Pollux	
	17	07	Venus 1°·6 N. of Moon	
	17	11	Saturn stationary	
	18	10	Mars 2° N. of Moon	
	19	07	Jupiter 2° N. of Moon	
	20	20	FIRST QUARTER	
	23	19	Juno stationary	
	28	12	FULL MOON	

CONFIGURATIONS OF SUN, MOON AND PLANETS

	d	h	
May	31	01	Venus 4° S. of Pollux
	31	03	Moon at apogee
	31	13	Uranus 0°·2 N. of Moon Occn.
	31	20	Neptune 1°·1 N. of Moon Occn.
June	2	14	Saturn 2° S. of Moon
	5	15	LAST QUARTER
	10	10	Ceres stationary
	12	12	NEW MOON
	13	00	Moon at perigee
	13	22	Venus greatest elong. E.(45°)
	14	05	Mars 0°·6 N. of Jupiter
	15	20	Venus 4° N. of Moon
	15	22	Jupiter 3° N. of Moon
	16	00	Mars 4° N. of Moon
	17	05	Mercury in superior conjunction
	17	23	Venus 1°·2 N. of Jupiter
	19	04	FIRST QUARTER
	21	21	Solstice
	23	12	Venus 0°·3 N. of Mars
	27	03	FULL MOON Penumbral Eclipse
	27	07	Moon at apogee
	27	17	Uranus 0°·3 N. of Moon Occn.
	28	00	Neptune 1°·1 N. of Moon Occn.
	29	18	Saturn 2° S. of Moon
	30	22	Mercury 5° S. of Pollux
July	4	07	Uranus at opposition
	5	03	LAST QUARTER
	6	15	Earth at aphelion
	8	00	Neptune at opposition
	9	19	Vesta in conjunction with Sun
	11	08	Venus 1°·0 S. of Regulus
	11	10	Moon at perigee
	11	19	NEW MOON Eclipse
	13	14	Mercury 3° N. of Moon
	13	17	Jupiter 3° N. of Moon
	14	15	Mars 5° N. of Moon
	14	16	Mars 0°·7 N. of Regulus
	14	18	Venus 3° N. of Moon
	15	08	Mercury 0°·08 S. of Jupiter
	16	23	Juno at opposition
	17	05	Venus greatest brilliancy
	18	15	FIRST QUARTER
	22	06	Venus 4° S. of Mars
	24	11	Moon at apogee
	24	21	Uranus 0°·4 N. of Moon Occn.
	25	02	Mercury greatest elong. E.(27°)
	25	05	Neptune 1°·2 N. of Moon
	26	18	FULL MOON Penumbral Eclipse
	26	20	Saturn 1°·9 S. of Moon
	27	00	Saturn at opposition
	27	01	Mercury 2° S. of Regulus

	d	h	
July	30	04	Venus stationary
Aug.	2	19	Pluto stationary
	3	11	LAST QUARTER
	7	04	Mercury stationary
	7	06	Mercury 2° N. of Venus
	8	18	Moon at perigee
	10	02	NEW MOON
	11	07	Venus 3° S. of Moon
	11	08	Mercury 0°·6 S. of Moon Occn.
	12	08	Mars 6° N. of Moon
	17	00	Venus 9° S. of Regulus
	17	05	FIRST QUARTER
	17	22	Jupiter in conjunction with Sun
	20	02	Moon at apogee
	21	02	Uranus 0°·4 N. of Moon Occn.
	21	10	Neptune 1°·2 N. of Moon
	21	21	Mercury in inferior conjunction
	22	20	Venus in inferior conjunction
	22	23	Saturn 1°·8 S. of Moon
	25	09	FULL MOON
	29	05	Mercury 6° N. of Venus
	30	20	Mercury stationary
Sept.	1	18	LAST QUARTER
	5	19	Moon at perigee
	6	17	Venus 5° S. of Moon
	6	18	Juno stationary
	7	05	Mercury 3° N. of Moon
	7	11	Jupiter 5° N. of Moon
	7	18	Mercury greatest elong. W.(18°)
	8	11	NEW MOON
	10	02	Mars 6° N. of Moon
	10	08	Jupiter 0°·4 N. of Regulus
	10	10	Mercury 0°·07 S. of Jupiter
	10	10	Mercury 0°·3 N. of Regulus
	12	02	Venus stationary
	15	22	FIRST QUARTER
	17	09	Uranus 0°·2 N. of Moon Occn.
	17	15	Moon at apogee
	17	17	Neptune 1°·0 N. of Moon Occn.
	19	04	Saturn 1°·8 S. of Moon
	19	09	Uranus stationary
	23	13	Equinox
	23	23	FULL MOON
	26	05	Neptune stationary
	28	23	Venus greatest brilliancy
Oct.	1	00	LAST QUARTER
	2	18	Moon at perigee
	3	17	Mercury in superior conjunction
	4	15	Venus 0°·2 N of Moon Occn.
	5	02	Saturn stationary

CONFIGURATIONS OF SUN, MOON AND PLANETS

	d	h	
Oct.	5	05	Jupiter 5° N. of Moon
	6	00	Mars 3° N. of Spica
	7	22	NEW MOON
	8	04	Venus 3° S. of Regulus
	14	18	Uranus 0°·06 S. of Moon Occn.
	15	02	Neptune 0°·7 N. of Moon Occn.
	15	11	Moon at apogee
	15	18	FIRST QUARTER
	16	12	Saturn 2° S. of Moon
	17	03	Venus 2° S. of Jupiter
	23	11	FULL MOON
	27	16	Moon at perigee
	30	07	LAST QUARTER
Nov.	1	20	Jupiter 6° N. of Moon
	2	09	Venus greatest elong. W.(47°)
	2	21	Venus 6° N. of Moon
	4	15	Pallas in conjunction with Sun
	6	11	NEW MOON
	8	05	Mercury 0°·7 N. of Moon Occn.
	8	09	Mars in conjunction with Sun
	11	03	Uranus 0°·4 S. of Moon Occn.
	11	07	Mercury 2° N. of Antares
	11	11	Neptune 0°·4 N. of Moon Occn.
	12	08	Moon at apogee
	12	22	Saturn 2°S. of Moon
	13	04	Pluto in conjunction with Sun
	14	14	FIRST QUARTER
	19	02	Mercury greatest elong. E.(22°)
	21	23	FULL MOON
	24	02	Moon at perigee
	28	15	LAST QUARTER
	28	18	Mercury stationary
	29	08	Jupiter 6° N. of Moon
	29	09	Venus 4° N. of Spica
Dec.	2	14	Venus 8° N. of Moon
	6	04	NEW MOON
	8	14	Uranus 0°·6 S. of Moon Occn.
	8	15	Mercury in inferior conjunction
	8	20	Neptune 0°·2 N. of Moon Occn.
	10	02	Moon at apogee
	10	10	Saturn 3° S. of Moon
	11	15	Mars 4° N. of Antares
	11	19	Ceres in conjunction with Sun
	13	16	Mercury 3° N. of Mars
	14	10	FIRST QUARTER
	15	22	Mercury 8° N. of Antares
	18	12	Mercury stationary
	21	06	Mercury 7° N. of Antares
	21	10	FULL MOON Eclipse
	22	09	Moon at perigee
	22	09	Solstice
	26	17	Jupiter 7° N. of Moon
	27	21	Mercury greatest elong. W.(22°)
	28	02	LAST QUARTER
	31	12	Jupiter stationary

PREDICTED PERIHELION PASSAGES OF COMETS, 1991

Periodic comet	Perihelion date	Revolution period years	Perihelion distance au
Russell 1	Jan. 3	7·6	2.17
Swift – Gehrels	Feb. 22	9·2	1.36
Wolf – Harrington	Apr. 4	6·5	1.61
Haneda – Campos	Apr. 11	6·3	1.22
Van Biesbroeck	Apr. 24	12·4	2.40
Hartley	May 18	6·0	1.82
Arend	May 26	8·0	1.85
Harrington – Abell	July 6	7·6	1.77
Kowal – Mrkos	July 18	9·3	2.68
Takamizawa	Aug. 18	7·2	1.59
Tsuchinshan 1	Aug. 30	6·6	1.50
Wirtanen	Sept. 20	5·5	1.08
Arend – Rigaux	Oct. 2	6·8	1.44
Faye	Nov. 16	7·3	1.59
Kowal 2	Dec. 28	6·5	1.50

CHRONOLOGICAL CYCLES AND ERAS

Dominical Letter	F	Julian Period (year of)	6704
Epact	14	Roman Indiction	14
Golden Number (Lunar Cycle)	XVI	Solar Cycle	12

All dates are given in terms of the Gregorian calendar in which 1991 January 14 corresponds to 1991 January 1 of the Julian calendar.

ERA	YEAR	BEGINS	ERA	YEAR	BEGINS
Byzantine	7500	Sept. 14	Japanese	2651	Jan. 1
Jewish (A.M.)*	5752	Sept. 8	Grecian (Seleucidæ)	2303	Sept. 14 (or Oct. 14)
Chinese	(4628)	Feb. 15			
Roman (A.U.C.)	2744	Jan. 14	Indian (Saka)	1913	Mar. 22
Nabonassar	2740	Apr. 26	Diocletian	1708	Sept. 12
			Islamic (Hegira)*	1412	July 12

* Year begins at sunset.

RELIGIOUS CALENDARS

Epiphany	Jan. 6	Ascension Day	May 9
Ash Wednesday	Feb. 13	Whit Sunday—Pentecost	May 19
Palm Sunday	Mar. 24	Trinity Sunday	May 26
Good Friday	Mar. 29	First Sunday in Advent	Dec. 1
Easter Day	Mar. 31	Christmas Day (Wednesday)	Dec. 25
First Day of Passover (Pesach)	Mar. 30	Day of Atonement (Yom Kippur)	Sept. 18
Feast of Weeks (Shavuot)	May 19	First day of Tabernacles (Succoth)	Sept. 23
Jewish New Year (tabular) (Rosh Hashanah)	Sept. 9	First day of Ramadân (tabular)	Mar. 17
Islamic New Year (tabular)	July 13		

The Jewish and Islamic dates above are tabular dates, which begin at sunset on the previous evening and end at sunset on the date tabulated. In practice, the dates of Islamic fasts and festivals are determined by an actual sighting of the appropriate new moon.

CIVIL CALENDAR—UNITED STATES OF AMERICA

New Year's Day	Jan. 1	Labor Day	Sept. 2
Martin Luther King's Birthday	Jan. 21	Columbus Day	Oct. 14
Lincoln's Birthday	Feb. 12	Election Day (in certain States)	Nov. 5
Washington's Birthday	Feb. 18	Veterans Day	Nov. 11
Memorial Day	May 27	Thanksgiving Day	Nov. 28
Independence Day	July 4		

CIVIL CALENDAR—UNITED KINGDOM

Accession of Queen Elizabeth II	Feb. 6	The Queen's Official Birthday†	June 8
St David (Wales)	Mar. 1	Birthday of Prince Philip, Duke of Edinburgh	June 10
Commonwealth Day	Mar. 11	Remembrance Sunday	Nov. 10
St Patrick (Ireland)	Mar. 17	Birthday of the Prince of Wales	Nov. 14
Birthday of Queen Elizabeth II	Apr. 21	St Andrew (Scotland)	Nov. 30
St George (England)	Apr. 23		
Coronation Day	June 2		

† Date subject to confirmation

Day of Month	JANUARY Day of Week	JANUARY Day of Year	FEBRUARY Day of Week	FEBRUARY Day of Year	MARCH Day of Week	MARCH Day of Year	APRIL Day of Week	APRIL Day of Year	MAY Day of Week	MAY Day of Year	JUNE Day of Week	JUNE Day of Year
1	Tue.	1	Fri.	32	Fri.	60	Mon.	91	Wed.	121	Sat.	152
2	Wed.	2	Sat.	33	Sat.	61	Tue.	92	Thu.	122	Sun.	153
3	Thu.	3	Sun.	34	Sun.	62	Wed.	93	Fri.	123	Mon.	154
4	Fri.	4	Mon.	35	Mon.	63	Thu.	94	Sat.	124	Tue.	155
5	Sat.	5	Tue.	36	Tue.	64	Fri.	95	Sun.	125	Wed.	156
6	Sun.	6	Wed.	37	Wed.	65	Sat.	96	Mon.	126	Thu.	157
7	Mon.	7	Thu.	38	Thu.	66	Sun.	97	Tue.	127	Fri.	158
8	Tue.	8	Fri.	39	Fri.	67	Mon.	98	Wed.	128	Sat.	159
9	Wed.	9	Sat.	40	Sat.	68	Tue.	99	Thu.	129	Sun.	160
10	Thu.	10	Sun.	41	Sun.	69	Wed.	100	Fri.	130	Mon.	161
11	Fri.	11	Mon.	42	Mon.	70	Thu.	101	Sat.	131	Tue.	162
12	Sat.	12	Tue.	43	Tue.	71	Fri.	102	Sun.	132	Wed.	163
13	Sun.	13	Wed.	44	Wed.	72	Sat.	103	Mon.	133	Thu.	164
14	Mon.	14	Thu.	45	Thu.	73	Sun.	104	Tue.	134	Fri.	165
15	Tue.	15	Fri.	46	Fri.	74	Mon.	105	Wed.	135	Sat.	166
16	Wed.	16	Sat.	47	Sat.	75	Tue.	106	Thu.	136	Sun.	167
17	Thu.	17	Sun.	48	Sun.	76	Wed.	107	Fri.	137	Mon.	168
18	Fri.	18	Mon.	49	Mon.	77	Thu.	108	Sat.	138	Tue.	169
19	Sat.	19	Tue.	50	Tue.	78	Fri.	109	Sun.	139	Wed.	170
20	Sun.	20	Wed.	51	Wed.	79	Sat.	110	Mon.	140	Thu.	171
21	Mon.	21	Thu.	52	Thu.	80	Sun.	111	Tue.	141	Fri.	172
22	Tue.	22	Fri.	53	Fri.	81	Mon.	112	Wed.	142	Sat.	173
23	Wed.	23	Sat.	54	Sat.	82	Tue.	113	Thu.	143	Sun.	174
24	Thu.	24	Sun.	55	Sun.	83	Wed.	114	Fri.	144	Mon.	175
25	Fri.	25	Mon.	56	Mon.	84	Thu.	115	Sat.	145	Tue.	176
26	Sat.	26	Tue.	57	Tue.	85	Fri.	116	Sun.	146	Wed.	177
27	Sun.	27	Wed.	58	Wed.	86	Sat.	117	Mon.	147	Thu.	178
28	Mon.	28	Thu	59	Thu.	87	Sun.	118	Tue.	148	Fri.	179
29	Tue.	29			Fri.	88	Mon.	119	Wed.	149	Sat.	180
30	Wed.	30			Sat.	89	Tue.	120	Thu.	150	Sun.	181
31	Thu.	31			Sun.	90			Fri.	151		

JULIAN DATE, 1991

0^hUT				0^hUT				0^hUT				0^hUT			
Jan.	0	244	8256·5	Apr.	0	244	8346·5	July	0	244	8437·5	Oct.	0	244	8529·5
Feb.	0	244	8287·5	May	0	244	8376·5	Aug.	0	244	8468·5	Nov.	0	244	8560·5
Mar.	0	244	8315·5	June	0	244	8407·5	Sept.	0	244	8499·5	Dec.	0	244	8590·5

400-day date: JD 244 8400·5 = 1991 May 24·0

Standard epoch, 1900 January 0, 12^h UT = JD 241 5020·000
Standard epoch, B1950·0 = 1950 Jan. 0·923 = JD 243 3282·423
B1991·0 = 1991 Jan. 0·854 = JD 244 8257·354
J1991·5 = 1991 July 2·875 = JD 244 8440·375
Standard epoch, J2000·0 = 2000 Jan. 1·5 = JD 245 1545·000

Day of Month	JULY Day of Week	JULY Day of Year	AUGUST Day of Week	AUGUST Day of Year	SEPTEMBER Day of Week	SEPTEMBER Day of Year	OCTOBER Day of Week	OCTOBER Day of Year	NOVEMBER Day of Week	NOVEMBER Day of Year	DECEMBER Day of Week	DECEMBER Day of Year
1	Mon.	182	Thu.	213	Sun.	244	Tue.	274	Fri.	305	Sun.	335
2	Tue.	183	Fri.	214	Mon.	245	Wed.	275	Sat.	306	Mon.	336
3	Wed.	184	Sat.	215	Tue.	246	Thu.	276	Sun.	307	Tue.	337
4	Thu.	185	Sun.	216	Wed.	247	Fri.	277	Mon.	308	Wed.	338
5	Fri.	186	Mon.	217	Thu.	248	Sat.	278	Tue.	309	Thu.	339
6	Sat.	187	Tue.	218	Fri.	249	Sun.	279	Wed.	310	Fri.	340
7	Sun.	188	Wed.	219	Sat.	250	Mon.	280	Thu.	311	Sat.	341
8	Mon.	189	Thu.	220	Sun.	251	Tue.	281	Fri.	312	Sun.	342
9	Tue.	190	Fri.	221	Mon.	252	Wed.	282	Sat.	313	Mon.	343
10	Wed.	191	Sat.	222	Tue.	253	Thu.	283	Sun.	314	Tue.	344
11	Thu.	192	Sun.	223	Wed.	254	Fri.	284	Mon.	315	Wed.	345
12	Fri.	193	Mon.	224	Thu.	255	Sat.	285	Tue.	316	Thu.	346
13	Sat.	194	Tue.	225	Fri.	256	Sun.	286	Wed.	317	Fri.	347
14	Sun.	195	Wed.	226	Sat.	257	Mon.	287	Thu.	318	Sat.	348
15	Mon.	196	Thu.	227	Sun.	258	Tue.	288	Fri.	319	Sun.	349
16	Tue.	197	Fri.	228	Mon.	259	Wed.	289	Sat.	320	Mon.	350
17	Wed.	198	Sat.	229	Tue.	260	Thu.	290	Sun.	321	Tue.	351
18	Thu.	199	Sun.	230	Wed.	261	Fri.	291	Mon.	322	Wed.	352
19	Fri.	200	Mon.	231	Thu.	262	Sat.	292	Tue.	323	Thu.	353
20	Sat.	201	Tue.	232	Fri.	263	Sun.	293	Wed.	324	Fri.	354
21	Sun.	202	Wed.	233	Sat.	264	Mon.	294	Thu.	325	Sat.	355
22	Mon.	203	Thu.	234	Sun.	265	Tue.	295	Fri.	326	Sun.	356
23	Tue.	204	Fri.	235	Mon.	266	Wed.	296	Sat.	327	Mon.	357
24	Wed.	205	Sat.	236	Tue.	267	Thu.	297	Sun.	328	Tue.	358
25	Thu.	206	Sun.	237	Wed.	268	Fri.	298	Mon.	329	Wed.	359
26	Fri.	207	Mon.	238	Thu.	269	Sat.	299	Tue.	330	Thu.	360
27	Sat.	208	Tue.	239	Fri.	270	Sun.	300	Wed.	331	Fri.	361
28	Sun.	209	Wed.	240	Sat.	271	Mon.	301	Thu.	332	Sat.	362
29	Mon.	210	Thu.	241	Sun.	272	Tue.	302	Fri.	333	Sun.	363
30	Tue.	211	Fri.	242	Mon.	273	Wed.	303	Sat.	334	Mon.	364
31	Wed.	212	Sat.	243			Thu.	304			Tue.	365

MEAN SIDEREAL TIME, 1991

Greenwich mean sidereal time at 0^h UT

	h		h		h		h
Jan. 0	06·6106	Apr. 0	12·5245	July 0	18·5041	Oct. 0	00·5494
Feb. 0	08·6476	May 0	14·4958	Aug. 0	20·5411	Nov. 0	02·5864
Mar. 0	10·4875	June 0	16·5328	Sept. 0	22·5781	Dec. 0	04·5577

Greenwich mean sidereal time (GMST) on day d of month at hour t UT
= GMST at 0^h UT on day $0 + 0^h{\cdot}06571\ d + 1^h{\cdot}00274\ t$

$$\text{Local mean sidereal time} = \text{GMST} \begin{matrix} + \text{ east} \\ - \text{ west} \end{matrix} \text{ longitude}$$

AT 0^h UNIVERSAL TIME

Date	Equation of time	Declination	Date	Equation of time	Declination	Date	Equation of time	Declination	Date	Equation of time	Declination
	m s	° ′		m s	° ′		m s	° ′		m s	° ′
Jan. 0	−02 41	−23 08	**Feb. 15**	−14 11	−12 55	**Apr. 1**	−04 09	+04 16	**May 17**	+03 40	+19 10
1	03 10	23 04	**16**	14 09	12 35	**2**	03 51	04 39	**18**	03 39	19 23
2	03 38	22 59	**17**	14 05	12 14	**3**	03 34	05 02	**19**	03 37	19 37
3	04 06	22 53	**18**	14 01	11 53	**4**	03 16	05 25	**20**	03 34	19 50
4	04 33	22 48	**19**	13 56	11 32	**5**	02 58	05 48	**21**	03 31	20 02
5	−05 01	−22 42	**20**	−13 51	−11 11	**6**	−02 41	+06 11	**22**	+03 27	+20 15
6	05 28	22 35	**21**	13 45	10 49	**7**	02 24	06 33	**23**	03 22	20 26
7	05 54	22 28	**22**	13 38	10 27	**8**	02 07	06 56	**24**	03 18	20 38
8	06 20	22 20	**23**	13 30	10 06	**9**	01 50	07 18	**25**	03 12	20 49
9	06 45	22 12	**24**	13 22	09 44	**10**	01 34	07 41	**26**	03 07	21 00
10	−07 10	−22 04	**25**	−13 13	−09 21	**11**	−01 17	+08 03	**27**	+03 00	+21 10
11	07 35	21 55	**26**	13 04	08 59	**12**	01 01	08 25	**28**	02 54	21 21
12	07 59	21 46	**27**	12 54	08 37	**13**	00 46	08 47	**29**	02 46	21 30
13	08 22	21 36	**28**	12 43	08 14	**14**	00 31	09 09	**30**	02 39	21 40
14	08 45	21 26	**Mar. 1**	12 32	07 52	**15**	00 16	09 30	**31**	02 31	21 49
15	−09 07	−21 15	**2**	−12 21	−07 29	**16**	−00 01	+09 52	**June 1**	+02 22	+21 57
16	09 28	21 04	**3**	12 09	07 06	**17**	+00 13	10 13	**2**	02 13	22 06
17	09 49	20 53	**4**	11 56	06 43	**18**	00 27	10 34	**3**	02 04	22 13
18	10 09	20 41	**5**	11 43	06 20	**19**	00 40	10 55	**4**	01 54	22 21
19	10 28	20 29	**6**	11 30	05 57	**20**	00 54	11 16	**5**	01 44	22 28
20	−10 47	−20 17	**7**	−11 16	−05 33	**21**	+01 06	+11 37	**6**	+01 33	+22 35
21	11 05	20 04	**8**	11 01	05 10	**22**	01 19	11 57	**7**	01 23	22 41
22	11 22	19 50	**9**	10 47	04 47	**23**	01 31	12 17	**8**	01 11	22 47
23	11 38	19 37	**10**	10 32	04 23	**24**	01 42	12 37	**9**	01 00	22 52
24	11 54	19 23	**11**	10 16	04 00	**25**	01 53	12 57	**10**	00 48	22 57
25	−12 08	−19 08	**12**	−10 01	−03 36	**26**	+02 04	+13 17	**11**	+00 36	+23 02
26	12 22	18 54	**13**	09 45	03 13	**27**	02 14	13 36	**12**	00 24	23 06
27	12 35	18 38	**14**	09 29	02 49	**28**	02 23	13 55	**13**	+00 12	23 10
28	12 48	18 23	**15**	09 12	02 25	**29**	02 32	14 14	**14**	−00 01	23 14
29	12 59	18 07	**16**	08 55	02 02	**30**	02 41	14 33	**15**	00 14	23 17
30	−13 10	−17 51	**17**	−08 38	−01 38	**May 1**	+02 49	+14 51	**16**	−00 27	+23 19
31	13 20	17 35	**18**	08 21	01 14	**2**	02 56	15 10	**17**	00 39	23 22
Feb. 1	13 28	17 18	**19**	08 04	00 50	**3**	03 03	15 28	**18**	00 52	23 23
2	13 37	17 01	**20**	07 46	00 27	**4**	03 10	15 45	**19**	01 06	23 25
3	13 44	16 44	**21**	07 29	−00 03	**5**	03 16	16 03	**20**	01 19	23 26
4	−13 51	−16 26	**22**	−07 11	+00 21	**6**	+03 21	+16 20	**21**	−01 32	+23 26
5	13 56	16 08	**23**	06 53	00 44	**7**	03 26	16 37	**22**	01 45	23 26
6	14 01	15 50	**24**	06 35	01 08	**8**	03 30	16 53	**23**	01 58	23 26
7	14 06	15 32	**25**	06 17	01 32	**9**	03 33	17 10	**24**	02 11	23 26
8	14 09	15 13	**26**	05 59	01 55	**10**	03 36	17 26	**25**	02 23	23 24
9	−14 12	−14 54	**27**	−05 40	+02 19	**11**	+03 39	+17 42	**26**	−02 36	+23 23
10	14 13	14 35	**28**	05 22	02 42	**12**	03 40	17 57	**27**	02 49	23 21
11	14 14	14 16	**29**	05 04	03 06	**13**	03 41	18 12	**28**	03 01	23 19
12	14 15	13 56	**30**	04 46	03 29	**14**	03 42	18 27	**29**	03 13	23 16
13	14 14	13 36	**31**	04 27	03 52	**15**	03 42	18 42	**30**	03 25	23 13
14	−14 13	−13 16	**Apr. 1**	−04 09	+04 16	**16**	+03 41	+18 56	**July 1**	−03 37	+23 09
15	−14 11	−12 55	**2**	−03 51	+04 39	**17**	+03 40	+19 10	**2**	−03 49	+23 05

Equation of time = apparent time − mean time

AT 0h UNIVERSAL TIME

Date	Equation of time	Declination	Date	Equation of time	Declination	Date	Equation of time	Declination	Date	Equation of time	Declination
	m s	° ′		m s	° ′		m s	° ′		m s	° ′
July 1	−03 37	+23 09	Aug. 16	−04 27	+13 58	Oct. 1	+10 02	−02 54	Nov. 16	+15 22	−18 33
2	03 49	23 05	17	04 15	13 39	2	10 21	03 18	17	15 11	18 48
3	04 00	23 01	18	04 03	13 20	3	10 40	03 41	18	15 00	19 03
4	04 11	22 56	19	03 49	13 01	4	10 59	04 04	19	14 47	19 17
5	04 22	22 51	20	03 36	12 41	5	11 18	04 27	20	14 34	19 31
6	−04 33	+22 46	21	−03 21	+12 21	6	+11 36	−04 50	21	+14 20	−19 45
7	04 43	22 40	22	03 07	12 01	7	11 53	05 13	22	14 06	19 58
8	04 53	22 33	23	02 52	11 41	8	12 11	05 36	23	13 50	20 11
9	05 02	22 27	24	02 36	11 21	9	12 27	05 59	24	13 34	20 24
10	05 11	22 20	25	02 20	11 00	10	12 44	06 22	25	13 17	20 36
11	−05 20	+22 12	26	−02 04	+10 40	11	+13 00	−06 45	26	+12 59	−20 48
12	05 28	22 04	27	01 47	10 19	12	13 15	07 08	27	12 40	21 00
13	05 36	21 56	28	01 29	09 58	13	13 30	07 30	28	12 21	21 11
14	05 43	21 47	29	01 12	09 37	14	13 45	07 53	29	12 00	21 21
15	05 50	21 38	30	00 54	09 16	15	13 59	08 15	30	11 40	21 31
16	−05 57	+21 29	31	−00 36	+08 54	16	+14 13	−08 37	Dec. 1	+11 18	−21 41
17	06 02	21 19	Sept. 1	−00 17	08 33	17	14 25	08 59	2	10 56	21 51
18	06 08	21 09	2	+00 02	08 11	18	14 38	09 21	3	10 33	22 00
19	06 12	20 59	3	00 21	07 49	19	14 50	09 43	4	10 09	22 08
20	06 17	20 48	4	00 41	07 27	20	15 01	10 05	5	09 45	22 16
21	−06 20	+20 37	5	+01 00	+07 05	21	+15 12	−10 26	6	+09 20	−22 24
22	06 23	20 25	6	01 20	06 43	22	15 21	10 48	7	08 55	22 31
23	06 26	20 13	7	01 40	06 20	23	15 31	11 09	8	08 29	22 38
24	06 27	20 01	8	02 01	05 58	24	15 39	11 30	9	08 03	22 45
25	06 29	19 49	9	02 21	05 35	25	15 47	11 51	10	07 36	22 51
26	−06 29	+19 36	10	+02 42	+05 13	26	+15 55	−12 12	11	+07 09	−22 56
27	06 29	19 23	11	03 02	04 50	27	16 01	12 32	12	06 42	23 01
28	06 29	19 09	12	03 23	04 27	28	16 07	12 53	13	06 14	23 06
29	06 28	18 55	13	03 45	04 04	29	16 12	13 13	14	05 45	23 10
30	06 26	18 41	14	04 06	03 41	30	16 16	13 33	15	05 17	23 14
31	−06 24	+18 27	15	+04 27	+03 18	31	+16 19	−13 52	16	+04 48	−23 17
Aug. 1	06 21	18 12	16	04 48	02 55	Nov. 1	16 22	14 12	17	04 19	23 20
2	06 17	17 57	17	05 10	02 32	2	16 24	14 31	18	03 50	23 22
3	06 13	17 42	18	05 31	02 09	3	16 25	14 50	19	03 21	23 24
4	06 09	17 26	19	05 53	01 46	4	16 25	15 09	20	02 51	23 25
5	−06 03	+17 10	20	+06 14	+01 22	5	+16 24	−15 27	21	+02 21	−23 26
6	05 58	16 54	21	06 35	00 59	6	16 23	15 46	22	01 52	23 26
7	05 51	16 37	22	06 57	00 36	7	16 20	16 04	23	01 22	23 26
8	05 44	16 21	23	07 18	+00 12	8	16 17	16 22	24	00 52	23 26
9	05 37	16 04	24	07 39	−00 11	9	16 13	16 39	25	+00 22	23 25
10	−05 28	+15 46	25	+08 00	−00 34	10	+16 08	−16 56	26	−00 07	−23 23
11	05 20	15 29	26	08 21	00 58	11	16 03	17 13	27	00 37	23 21
12	05 10	15 11	27	08 41	01 21	12	15 56	17 30	28	01 07	23 19
13	05 00	14 53	28	09 02	01 44	13	15 49	17 46	29	01 36	23 16
14	04 50	14 35	29	09 22	02 08	14	15 41	18 02	30	02 05	23 13
15	−04 39	+14 17	30	+09 42	−02 31	15	+15 32	−18 18	31	−02 34	−23 09
16	−04 27	+13 58	Oct. 1	+10 02	−02 54	16	+15 22	−18 33	32	−03 03	−23 05

UT of transit = $12^h \begin{matrix} - \text{ east} \\ + \text{ west} \end{matrix}$ longitude − equation of time

AT 0^h UNIVERSAL TIME

Date	*Polaris* GHA	σ Oct GHA	Date	*Polaris* GHA	σ Oct GHA	Date	*Polaris* GHA	σ Oct GHA	Date	*Polaris* GHA	σ Oct GHA
	° ′	° ′		° ′	° ′		° ′	° ′		° ′	° ′
Jan. 0	63 24	144 11	**Feb. 15**	109 01	189 31	**Apr. 1**	153 35	233 43	**May 17**	198 54	278 48
1	64 23	145 10	**16**	110 01	190 30	**2**	154 34	234 42	**18**	199 53	279 47
2	65 23	146 09	**17**	111 00	191 29	**3**	155 34	235 41	**19**	200 52	280 46
3	66 22	147 08	**18**	112 00	192 28	**4**	156 33	236 39	**20**	201 51	281 45
4	67 22	148 08	**19**	112 59	193 27	**5**	157 32	237 38	**21**	202 50	282 43
5	68 21	149 07	**20**	113 59	194 26	**6**	158 31	238 37	**22**	203 49	283 42
6	69 21	150 06	**21**	114 58	195 25	**7**	159 30	239 36	**23**	204 48	284 41
7	70 20	151 05	**22**	115 58	196 24	**8**	160 30	240 35	**24**	205 47	285 40
8	71 20	152 05	**23**	116 57	197 23	**9**	161 29	241 33	**25**	206 45	286 39
9	72 19	153 04	**24**	117 57	198 22	**10**	162 28	242 32	**26**	207 44	287 38
10	73 19	154 03	**25**	118 56	199 21	**11**	163 28	243 31	**27**	208 43	288 37
11	74 18	155 02	**26**	119 56	200 20	**12**	164 27	244 30	**28**	209 42	289 35
12	75 17	156 02	**27**	120 55	201 19	**13**	165 26	245 29	**29**	210 41	290 34
13	76 17	157 01	**28**	121 55	202 18	**14**	166 25	246 28	**30**	211 40	291 33
14	77 16	158 00	**Mar. 1**	122 54	203 17	**15**	167 24	247 26	**31**	212 38	292 32
15	78 16	158 59	**2**	123 54	204 16	**16**	168 23	248 25	**June 1**	213 37	293 31
16	79 15	159 58	**3**	124 53	205 15	**17**	169 23	249 24	**2**	214 36	294 29
17	80 15	160 57	**4**	125 53	206 14	**18**	170 22	250 23	**3**	215 35	295 28
18	81 15	161 57	**5**	126 52	207 13	**19**	171 21	251 22	**4**	216 34	296 27
19	82 14	162 56	**6**	127 52	208 12	**20**	172 20	252 21	**5**	217 33	297 26
20	83 14	163 55	**7**	128 51	209 11	**21**	173 19	253 19	**6**	218 32	298 25
21	84 13	164 54	**8**	129 50	210 10	**22**	174 18	254 18	**7**	219 31	299 24
22	85 13	165 53	**9**	130 50	211 09	**23**	175 17	255 17	**8**	220 29	300 22
23	86 12	166 52	**10**	131 49	212 07	**24**	176 16	256 16	**9**	221 28	301 21
24	87 12	167 52	**11**	132 49	213 06	**25**	177 16	257 14	**10**	222 27	302 20
25	88 11	168 51	**12**	133 48	214 05	**26**	178 15	258 13	**11**	223 26	303 19
26	89 11	169 50	**13**	134 47	215 04	**27**	179 14	259 12	**12**	224 24	304 18
27	90 10	170 49	**14**	135 47	216 03	**28**	180 13	260 11	**13**	225 23	305 17
28	91 10	171 48	**15**	136 46	217 02	**29**	181 12	261 10	**14**	226 22	306 16
29	92 09	172 47	**16**	137 46	218 01	**30**	182 11	262 09	**15**	227 21	307 14
30	93 09	173 46	**17**	138 45	219 00	**May 1**	183 10	263 08	**16**	228 20	308 13
31	94 08	174 45	**18**	139 45	219 59	**2**	184 09	264 06	**17**	229 18	309 12
Feb. 1	95 08	175 44	**19**	140 44	220 58	**3**	185 08	265 05	**18**	230 17	310 11
2	96 08	176 43	**20**	141 43	221 56	**4**	186 07	266 04	**19**	231 16	311 10
3	97 07	177 43	**21**	142 43	222 55	**5**	187 06	267 03	**20**	232 15	312 09
4	98 07	178 42	**22**	143 42	223 54	**6**	188 05	268 01	**21**	233 14	313 08
5	99 06	179 41	**23**	144 41	224 53	**7**	189 04	269 00	**22**	234 12	314 07
6	100 06	180 40	**24**	145 40	225 52	**8**	190 03	269 59	**23**	235 11	315 05
7	101 05	181 39	**25**	146 40	226 51	**9**	191 02	270 58	**24**	236 10	316 04
8	102 05	182 38	**26**	147 39	227 50	**10**	192 01	271 57	**25**	237 09	317 03
9	103 04	183 37	**27**	148 39	228 48	**11**	193 00	272 55	**26**	238 07	318 02
10	104 04	184 36	**28**	149 38	229 47	**12**	193 59	273 54	**27**	239 06	319 01
11	105 03	185 35	**29**	150 37	230 46	**13**	194 58	274 53	**28**	240 05	320 00
12	106 03	186 34	**30**	151 37	231 45	**14**	195 57	275 52	**29**	241 03	320 59
13	107 02	187 33	**31**	152 36	232 44	**15**	196 56	276 51	**30**	242 02	321 58
14	108 02	188 32	**Apr. 1**	153 35	233 43	**16**	197 55	277 50	**July 1**	243 01	322 57
15	109 01	189 31	**2**	154 34	234 42	**17**	198 54	278 48	**2**	244 00	323 55

The dates between Jan. 0 and Dec. 32 below are the dates when p changes to the next value.

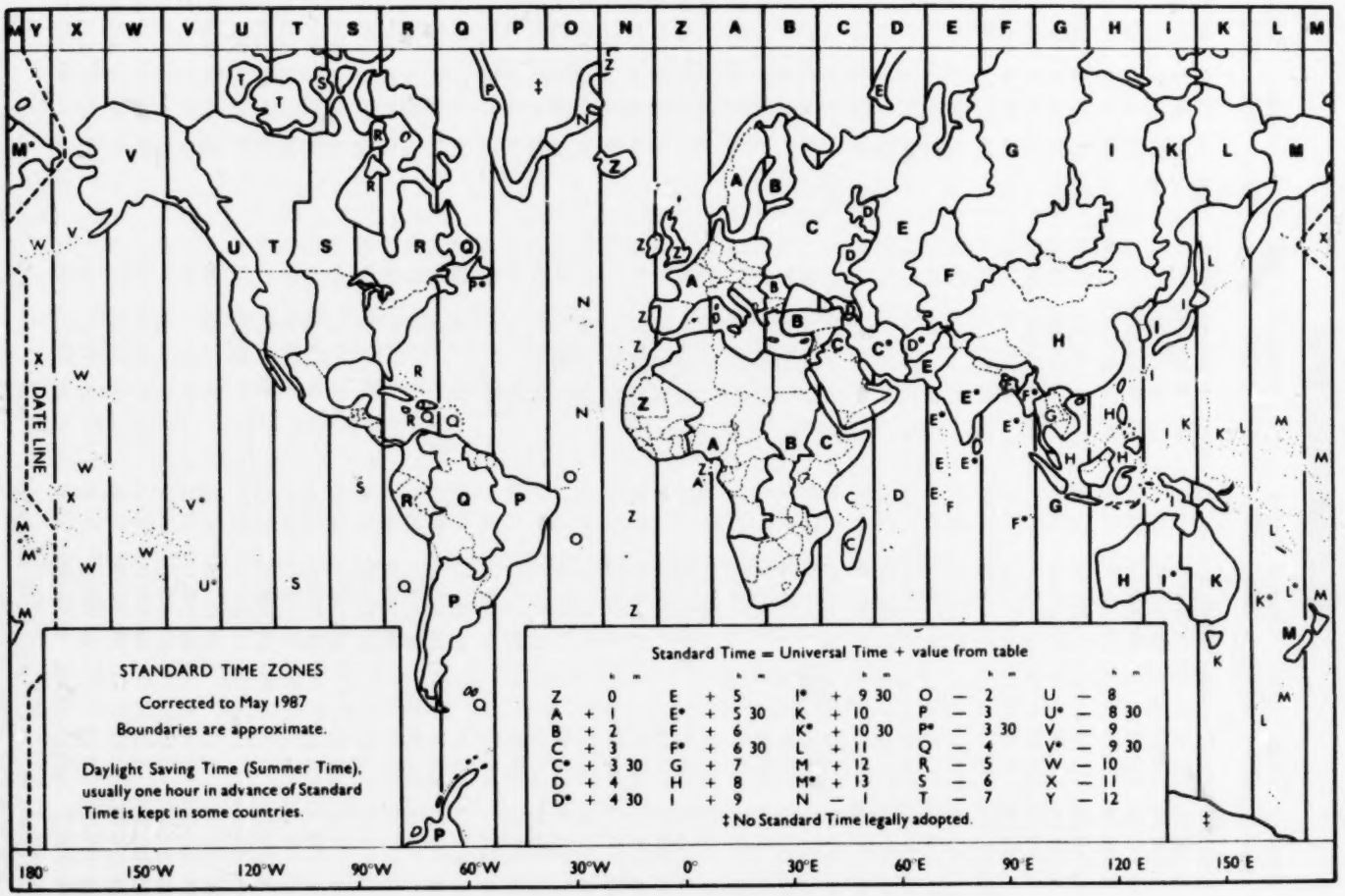
Polar distance (p) *Polaris*: Jan. 0 46′ May 24 47′ Sept. 8 46′ Dec. 32

σ Octantis: Jan. 0 60′ Feb. 10 61′ Sept. 7 60′ Dec. 25 61′ Dec. 32

AT 0^h UNIVERSAL TIME

Date	*Polaris* GHA	σ Oct GHA	Date	*Polaris* GHA	σ Oct GHA	Date	*Polaris* GHA	σ Oct GHA	Date	*Polaris* GHA	σ Oct GHA
	° ′	° ′		° ′	° ′		° ′	° ′		° ′	° ′
July 1	243 01	322 57	**Aug. 16**	288 02	8 12	**Oct. 1**	333 06	53 38	**Nov. 16**	18 21	99 12
2	244 00	323 55	**17**	289 01	9 11	**2**	334 05	54 38	**17**	19 20	100 11
3	244 59	324 54	**18**	289 59	10 10	**3**	335 04	55 37	**18**	20 20	101 11
4	245 57	325 53	**19**	290 58	11 09	**4**	336 03	56 36	**19**	21 19	102 10
5	246 56	326 52	**20**	291 57	12 08	**5**	337 02	57 36	**20**	22 18	103 10
6	247 55	327 51	**21**	292 55	13 08	**6**	338 01	58 35	**21**	23 17	104 09
7	248 54	328 50	**22**	293 54	14 07	**7**	339 00	59 34	**22**	24 16	105 09
8	249 52	329 49	**23**	294 53	15 06	**8**	339 59	60 34	**23**	25 15	106 08
9	250 51	330 48	**24**	295 52	16 05	**9**	340 57	61 33	**24**	26 14	107 07
10	251 49	331 47	**25**	296 50	17 04	**10**	341 56	62 33	**25**	27 14	108 07
11	252 48	332 46	**26**	297 49	18 03	**11**	342 55	63 32	**26**	28 13	109 06
12	253 47	333 45	**27**	298 48	19 03	**12**	343 54	64 32	**27**	29 12	110 05
13	254 46	334 44	**28**	299 47	20 02	**13**	344 53	65 31	**28**	30 12	111 05
14	255 44	335 43	**29**	300 46	21 01	**14**	345 52	66 30	**29**	31 11	112 04
15	256 43	336 42	**30**	301 44	22 00	**15**	346 51	67 30	**30**	32 10	113 04
16	257 42	337 41	**31**	302 43	23 00	**16**	347 50	68 29	**Dec. 1**	33 09	114 03
17	258 41	338 40	**Sept. 1**	303 42	23 59	**17**	348 49	69 29	**2**	34 09	115 03
18	259 39	339 39	**2**	304 40	24 58	**18**	349 48	70 28	**3**	35 08	116 02
19	260 38	340 38	**3**	305 39	25 57	**19**	350 47	71 27	**4**	36 07	117 01
20	261 37	341 37	**4**	306 38	26 57	**20**	351 46	72 27	**5**	37 06	118 01
21	262 35	342 36	**5**	307 37	27 56	**21**	352 45	73 26	**6**	38 06	119 00
22	263 34	343 35	**6**	308 35	28 55	**22**	353 44	74 26	**7**	39 05	120 00
23	264 33	344 34	**7**	309 34	29 54	**23**	354 43	75 25	**8**	40 04	120 59
24	265 31	345 33	**8**	310 33	30 53	**24**	355 42	76 25	**9**	41 04	121 58
25	266 30	346 32	**9**	311 32	31 53	**25**	356 41	77 24	**10**	42 03	122 58
26	267 29	347 31	**10**	312 31	32 52	**26**	357 40	78 24	**11**	43 02	123 57
27	268 28	348 30	**11**	313 30	33 51	**27**	358 39	79 23	**12**	44 02	124 56
28	269 26	349 29	**12**	314 28	34 51	**28**	359 38	80 22	**13**	45 01	125 56
29	270 25	350 28	**13**	315 27	35 50	**29**	0 37	81 22	**14**	46 01	126 55
30	271 24	351 27	**14**	316 26	36 49	**30**	1 36	82 21	**15**	47 00	127 54
31	272 23	352 26	**15**	317 25	37 49	**31**	2 35	83 21	**16**	47 59	128 54
Aug. 1	273 21	353 25	**16**	318 23	38 48	**Nov. 1**	3 34	84 20	**17**	48 59	129 53
2	274 20	354 24	**17**	319 22	39 47	**2**	4 33	85 20	**18**	49 58	130 53
3	275 19	355 23	**18**	320 21	40 47	**3**	5 32	86 19	**19**	50 57	131 52
4	276 17	356 22	**19**	321 20	41 46	**4**	6 32	87 18	**20**	51 57	132 51
5	277 16	357 22	**20**	322 19	42 45	**5**	7 31	88 18	**21**	52 56	133 51
6	278 15	358 21	**21**	323 18	43 44	**6**	8 30	89 17	**22**	53 55	134 50
7	279 13	359 20	**22**	324 16	44 44	**7**	9 29	90 17	**23**	54 55	135 49
8	280 12	0 19	**23**	325 15	45 43	**8**	10 28	91 16	**24**	55 54	136 48
9	281 11	1 18	**24**	326 14	46 43	**9**	11 27	92 16	**25**	56 54	137 48
10	282 09	2 17	**25**	327 13	47 42	**10**	12 26	93 15	**26**	57 53	138 47
11	283 08	3 16	**26**	328 12	48 41	**11**	13 25	94 15	**27**	58 53	139 46
12	284 07	4 15	**27**	329 11	49 41	**12**	14 24	95 14	**28**	59 52	140 46
13	285 06	5 14	**28**	330 10	50 40	**13**	15 23	96 13	**29**	60 52	141 45
14	286 04	6 13	**29**	331 08	51 40	**14**	16 23	97 13	**30**	61 51	142 44
15	287 03	7 13	**30**	332 07	52 39	**15**	17 22	98 12	**31**	62 50	143 44
16	288 02	8 12	**Oct. 1**	333 06	53 38	**16**	18 21	99 12	**32**	63 50	144 43

Form the quantities $C = p \cos$ (local hour angle) and $S = p \sin$ (local hour angle), then
Latitude $= h_0 - C + 0{\cdot}0087\, S^2 \tan h_0$,
Azimuth of *Polaris* $= -S / \cos h_0$ and Azimuth of σ Octantis $= 180° + S / \cos h_0$, where p and h_0 are in degrees and h_0 is the observed altitude corrected for atmospheric refraction and instrument error.


STANDARD TIME ZONES
Corrected to May 1987
Boundaries are approximate.
Daylight Saving Time (Summer Time), usually one hour in advance of Standard Time is kept in some countries.
DATE LINE
Standard Time = Universal Time + value from table
Z 0
A + 1
B + 2
C + 3
C* + 3 30
D + 4
D* + 4 30
E + 5
E* + 5 30
F + 6
F* + 6 30
G + 7
H + 8
I + 9
I* + 9 30
K + 10
K* + 10 30
L + 11
M + 12
M* + 13
N — 1
O — 2
P — 3
P* — 3 30
Q — 4
R — 5
S — 6
T — 7
U — 8
U* — 8 30
V — 9
V* — 9 30
W — 10
X — 11
Y — 12
‡ No Standard Time legally adopted.
180° 150°W 120°W 90°W 60°W 30°W 0° 30°E 60°E 90°E 120 E 150 E

The times of sunrise and sunset (pages 24–31) and of moonrise and moonset (pages 32–63) are the instants when the upper limbs of the Sun and Moon appear to lie on the horizon for an observer at sea-level. In both cases a fixed allowance of 34′ has been made for refraction; a further allowance of 16′ has been made for the semidiameter of the Sun, while for the Moon the actual value of semidiameter *minus* horizontal parallax has been used. No allowance has been made for the phase of the Moon. The observed times may differ from the tabular times because of variations in refraction and the relative heights of the observer and horizon.

The tabular values are for the universal time (UT) of the phenomena on the Greenwich meridian (longitude 0°). To a first approximation the UT at another longitude is given by subtracting the longitude, expressed in time-measure, if east of Greenwich, or by adding, if west of Greenwich. Alternatively the tables may be regarded as giving the approximate local mean time on all meridians. These times may be converted to standard time by applying the appropriate differences, as indicated in the note on page 4. Linear interpolation may be used to obtain the times for non-tabular latitudes.

In the case of the Sun it may be necessary to interpolate (mentally) to obtain the UT for an intermediate date, but a further interpolation for longitude is not normally required. In the case of the Moon the values must normally be interpolated for longitude, as well as for latitude, since the changes in the tabular values from one day to the next are usually large. The interpolating factor is equal to one twenty-fourth of the longitude if expressed in hours and decimals of an hour; linear interpolation is usually adequate.

Example

To find the times of sunrise and sunset and of moonrise and moonset on 1991 February 6 at latitude N 38° 55′, longitude W 77° 15′. The longitude expressed in time-measure is W $05^h\ 09^m$ The difference between standard time and UT is $-\ 5^h$ in this case.

The relevant tabular values in UT for longitude 0° are as follows:

	Sunrise		Sunset			Moonrise		Moonset	
	+35°	+40°	+35°	+40°		+35°	+40°	+35°	+40°
	d h m	h m	h m	h m		d h m	h m	h m	h m
Feb.	**3** 06 58	07 07	17 30	17 21	**Feb.**	**6** 00 22	00 34	10 38	10 25
	7 06 54	07 03	17 34	17 26		**7** 01 21	01 36	11 16	11 01

Interpolating factor for latitude is 3° 55′/5° = 0·78
„ „ „ date for Sun is $3^d/4^d$ = 0·75
„ „ „ long. for Moon is $5^h{\cdot}15/24^h$ = 0·21

	Sunrise	Sunset	Moonrise	Moonset
Interpolation to:	d h m	h m	d h m	h m
Latitude N 38° 55′	**Feb. 3** 07 05	17 23	**Feb. 6** 00 31	10 28
„ „	**7** 07 01	17 28	**7** 01 33	11 04
Local mean time	**6** 07 02	17 27	**6** 00 44	10 36
Adjustment to:				
Universal time	**6** 12 11	22 36	**6** 05 53	15 45
Standard time	**6** 07 11	17 36	**6** 00 53	10 45

SUNRISE AND SUNSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.		−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	−2	3 22	3 52	4 14	4 32	4 47	5 00	5 22	5 41	5 58	6 16	6 34	6 55	7 07	7 21
	2	3 27	3 56	4 18	4 35	4 50	5 03	5 24	5 43	6 00	6 17	6 35	6 56	7 08	7 22
	6	3 32	4 00	4 22	4 39	4 53	5 06	5 27	5 45	6 02	6 19	6 36	6 57	7 09	7 22
	10	3 38	4 05	4 26	4 43	4 57	5 09	5 30	5 47	6 04	6 20	6 37	6 57	7 09	7 22
	14	3 45	4 11	4 31	4 47	5 01	5 12	5 32	5 49	6 05	6 21	6 38	6 57	7 08	7 21
	18	3 52	4 17	4 36	4 52	5 05	5 16	5 35	5 51	6 07	6 22	6 38	6 56	7 07	7 19
	22	4 00	4 24	4 42	4 56	5 09	5 19	5 38	5 53	6 08	6 22	6 38	6 55	7 05	7 17
	26	4 09	4 30	4 47	5 01	5 13	5 23	5 40	5 55	6 09	6 23	6 37	6 54	7 03	7 14
	30	4 17	4 37	4 53	5 06	5 17	5 26	5 43	5 57	6 10	6 23	6 36	6 52	7 01	7 11
Feb.	3	4 26	4 44	4 59	5 11	5 21	5 30	5 45	5 58	6 10	6 22	6 35	6 49	6 58	7 07
	7	4 34	4 51	5 05	5 16	5 25	5 33	5 47	5 59	6 11	6 22	6 34	6 47	6 54	7 03
	11	4 43	4 58	5 11	5 21	5 29	5 37	5 49	6 01	6 11	6 21	6 32	6 44	6 51	6 59
	15	4 52	5 06	5 16	5 25	5 33	5 40	5 51	6 01	6 11	6 20	6 30	6 40	6 47	6 54
	19	5 00	5 13	5 22	5 30	5 37	5 43	5 53	6 02	6 11	6 19	6 27	6 37	6 42	6 48
	23	5 09	5 19	5 28	5 35	5 41	5 46	5 55	6 03	6 10	6 17	6 25	6 33	6 38	6 43
	27	5 17	5 26	5 34	5 40	5 45	5 49	5 57	6 03	6 09	6 15	6 22	6 29	6 33	6 37
Mar.	3	5 26	5 33	5 39	5 44	5 48	5 52	5 58	6 04	6 09	6 14	6 19	6 24	6 28	6 31
	7	5 34	5 40	5 44	5 48	5 52	5 55	6 00	6 04	6 08	6 12	6 16	6 20	6 22	6 25
	11	5 42	5 46	5 50	5 53	5 55	5 57	6 01	6 04	6 07	6 10	6 12	6 15	6 17	6 19
	15	5 50	5 53	5 55	5 57	5 59	6 00	6 02	6 04	6 06	6 07	6 09	6 11	6 12	6 13
	19	5 58	5 59	6 00	6 01	6 02	6 02	6 03	6 04	6 05	6 05	6 06	6 06	6 06	6 06
	23	6 06	6 06	6 05	6 05	6 05	6 05	6 04	6 04	6 03	6 03	6 02	6 01	6 00	6 00
	27	6 14	6 12	6 11	6 09	6 08	6 07	6 06	6 04	6 02	6 01	5 59	5 56	5 55	5 53
	31	6 21	6 18	6 16	6 13	6 11	6 10	6 07	6 04	6 01	5 58	5 55	5 51	5 49	5 47
Apr.	4	6 29	6 24	6 21	6 17	6 15	6 12	6 08	6 04	6 00	5 56	5 52	5 47	5 44	5 40

SUNSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	−2	20 41	20 12	19 49	19 32	19 17	19 04	18 42	18 23	18 06	17 48	17 30	17 09	16 57	16 43
	2	20 41	20 12	19 50	19 32	19 17	19 05	18 43	18 25	18 08	17 51	17 32	17 12	17 00	16 46
	6	20 39	20 11	19 49	19 32	19 18	19 05	18 44	18 26	18 09	17 53	17 35	17 15	17 03	16 49
	10	20 36	20 09	19 48	19 32	19 18	19 06	18 45	18 27	18 11	17 55	17 38	17 18	17 06	16 53
	14	20 32	20 06	19 46	19 30	19 17	19 05	18 46	18 28	18 13	17 57	17 40	17 21	17 10	16 58
	18	20 27	20 03	19 44	19 29	19 16	19 05	18 46	18 29	18 14	17 59	17 43	17 25	17 14	17 02
	22	20 21	19 58	19 41	19 26	19 14	19 03	18 45	18 30	18 15	18 01	17 45	17 28	17 18	17 07
	26	20 15	19 54	19 37	19 23	19 12	19 02	18 45	18 30	18 16	18 02	17 48	17 32	17 22	17 11
	30	20 08	19 48	19 33	19 20	19 09	19 00	18 44	18 30	18 17	18 04	17 50	17 35	17 26	17 16
Feb.	3	20 01	19 42	19 28	19 16	19 06	18 57	18 42	18 29	18 17	18 05	17 53	17 38	17 30	17 21
	7	19 53	19 36	19 23	19 12	19 03	18 54	18 41	18 29	18 18	18 07	17 55	17 42	17 34	17 26
	11	19 44	19 29	19 17	19 07	18 59	18 51	18 39	18 28	18 18	18 08	17 57	17 45	17 38	17 30
	15	19 35	19 22	19 11	19 02	18 55	18 48	18 37	18 27	18 18	18 09	17 59	17 48	17 42	17 35
	19	19 26	19 14	19 05	18 57	18 50	18 44	18 34	18 25	18 17	18 09	18 01	17 51	17 46	17 40
	23	19 17	19 06	18 58	18 51	18 45	18 40	18 31	18 24	18 17	18 10	18 03	17 54	17 50	17 44
	27	19 07	18 58	18 51	18 45	18 40	18 36	18 29	18 22	18 16	18 10	18 04	17 57	17 53	17 49
Mar.	3	18 57	18 50	18 44	18 39	18 35	18 32	18 26	18 20	18 15	18 11	18 06	18 00	17 57	17 53
	7	18 47	18 41	18 37	18 33	18 30	18 27	18 22	18 18	18 14	18 11	18 07	18 03	18 00	17 58
	11	18 37	18 33	18 30	18 27	18 25	18 22	18 19	18 16	18 13	18 11	18 08	18 05	18 04	18 02
	15	18 27	18 24	18 22	18 20	18 19	18 18	18 16	18 14	18 12	18 11	18 09	18 08	18 07	18 06
	19	18 17	18 16	18 15	18 14	18 13	18 13	18 12	18 12	18 11	18 11	18 11	18 10	18 10	18 10
	23	18 07	18 07	18 07	18 08	18 08	18 08	18 09	18 09	18 10	18 11	18 12	18 13	18 14	18 14
	27	17 56	17 58	18 00	18 01	18 02	18 03	18 05	18 07	18 09	18 11	18 13	18 15	18 17	18 19
	31	17 46	17 50	17 52	17 55	17 57	17 58	18 02	18 05	18 08	18 11	18 14	18 18	18 20	18 23
Apr.	4	17 36	17 41	17 45	17 48	17 51	17 54	17 58	18 02	18 06	18 10	18 15	18 20	18 23	18 27

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. −2	7 21	7 28	7 34	7 42	7 50	7 58	8 08	8 19	8 32	8 46	9 03	9 25	9 52	10 33
2	7 22	7 28	7 35	7 42	7 50	7 59	8 08	8 19	8 31	8 45	9 02	9 23	9 49	10 27
6	7 22	7 28	7 35	7 42	7 49	7 58	8 07	8 18	8 29	8 43	8 59	9 19	9 44	10 19
10	7 22	7 28	7 34	7 41	7 48	7 56	8 05	8 15	8 27	8 40	8 55	9 14	9 37	10 09
14	7 21	7 26	7 32	7 39	7 46	7 54	8 02	8 12	8 23	8 35	8 50	9 07	9 29	9 57
18	7 19	7 24	7 30	7 36	7 43	7 51	7 59	8 08	8 18	8 30	8 44	9 00	9 20	9 45
22	7 17	7 22	7 27	7 33	7 40	7 47	7 55	8 03	8 13	8 24	8 36	8 51	9 09	9 32
26	7 14	7 19	7 24	7 30	7 36	7 42	7 50	7 58	8 07	8 17	8 28	8 42	8 59	9 19
30	7 11	7 15	7 20	7 25	7 31	7 37	7 44	7 51	8 00	8 09	8 20	8 32	8 47	9 05
Feb. 3	7 07	7 11	7 16	7 21	7 26	7 31	7 38	7 44	7 52	8 01	8 10	8 22	8 35	8 51
7	7 03	7 07	7 11	7 15	7 20	7 25	7 31	7 37	7 44	7 52	8 01	8 11	8 22	8 37
11	6 59	7 02	7 06	7 10	7 14	7 19	7 24	7 29	7 35	7 42	7 50	7 59	8 10	8 22
15	6 54	6 57	7 00	7 04	7 07	7 12	7 16	7 21	7 27	7 33	7 40	7 47	7 57	8 07
19	6 48	6 51	6 54	6 57	7 01	7 04	7 08	7 13	7 17	7 23	7 29	7 35	7 43	7 53
23	6 43	6 45	6 48	6 51	6 53	6 57	7 00	7 04	7 08	7 12	7 17	7 23	7 30	7 38
27	6 37	6 39	6 41	6 44	6 46	6 49	6 51	6 55	6 58	7 02	7 06	7 11	7 16	7 23
Mar. 3	6 31	6 33	6 35	6 36	6 38	6 40	6 43	6 45	6 48	6 51	6 54	6 58	7 02	7 07
7	6 25	6 26	6 28	6 29	6 31	6 32	6 34	6 36	6 38	6 40	6 42	6 45	6 49	6 52
11	6 19	6 20	6 21	6 22	6 23	6 24	6 25	6 26	6 27	6 29	6 31	6 32	6 35	6 37
15	6 13	6 13	6 13	6 14	6 14	6 15	6 16	6 16	6 17	6 18	6 19	6 19	6 21	6 22
19	6 06	6 06	6 06	6 06	6 06	6 06	6 06	6 06	6 06	6 06	6 06	6 06	6 06	6 06
23	6 00	5 59	5 59	5 59	5 58	5 58	5 57	5 57	5 56	5 55	5 54	5 53	5 52	5 51
27	5 53	5 52	5 52	5 51	5 50	5 49	5 48	5 47	5 45	5 44	5 42	5 40	5 38	5 36
31	5 47	5 46	5 44	5 43	5 42	5 40	5 39	5 37	5 35	5 33	5 30	5 27	5 24	5 20
Apr. 4	5 40	5 39	5 37	5 35	5 34	5 32	5 29	5 27	5 24	5 21	5 18	5 14	5 10	5 05

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. −2	16 43	16 36	16 30	16 22	16 14	16 06	15 56	15 45	15 32	15 18	15 01	14 39	14 12	13 31
2	16 46	16 40	16 33	16 26	16 18	16 09	16 00	15 49	15 37	15 23	15 06	14 45	14 19	13 41
6	16 49	16 43	16 37	16 30	16 22	16 14	16 05	15 54	15 42	15 29	15 12	14 53	14 28	13 53
10	16 53	16 47	16 41	16 34	16 27	16 19	16 10	16 00	15 48	15 35	15 20	15 01	14 38	14 07
14	16 58	16 52	16 46	16 39	16 32	16 24	16 16	16 06	15 55	15 43	15 28	15 11	14 49	14 21
18	17 02	16 57	16 51	16 45	16 38	16 30	16 22	16 13	16 03	15 51	15 38	15 21	15 02	14 36
22	17 07	17 01	16 56	16 50	16 44	16 37	16 29	16 20	16 11	16 00	15 47	15 32	15 14	14 51
26	17 11	17 06	17 01	16 56	16 50	16 43	16 36	16 28	16 19	16 09	15 57	15 44	15 27	15 07
30	17 16	17 12	17 07	17 02	16 56	16 50	16 43	16 36	16 28	16 18	16 08	15 55	15 40	15 22
Feb. 3	17 21	17 17	17 12	17 07	17 02	16 57	16 51	16 44	16 36	16 28	16 18	16 07	15 54	15 38
7	17 26	17 22	17 18	17 13	17 09	17 04	16 58	16 52	16 45	16 37	16 29	16 19	16 07	15 53
11	17 30	17 27	17 23	17 19	17 15	17 11	17 06	17 00	16 54	16 47	16 39	16 30	16 20	16 08
15	17 35	17 32	17 29	17 25	17 22	17 17	17 13	17 08	17 03	16 57	16 50	16 42	16 33	16 22
19	17 40	17 37	17 34	17 31	17 28	17 24	17 20	17 16	17 11	17 06	17 00	16 53	16 46	16 37
23	17 44	17 42	17 40	17 37	17 34	17 31	17 28	17 24	17 20	17 16	17 11	17 05	16 58	16 51
27	17 49	17 47	17 45	17 43	17 40	17 38	17 35	17 32	17 29	17 25	17 21	17 16	17 11	17 05
Mar. 3	17 53	17 52	17 50	17 48	17 47	17 45	17 42	17 40	17 37	17 34	17 31	17 27	17 23	17 18
7	17 58	17 57	17 55	17 54	17 53	17 51	17 49	17 48	17 46	17 43	17 41	17 38	17 35	17 32
11	18 02	18 01	18 00	18 00	17 59	17 58	17 57	17 55	17 54	17 53	17 51	17 49	17 47	17 45
15	18 06	18 06	18 05	18 05	18 05	18 04	18 04	18 03	18 02	18 02	18 01	18 00	17 59	17 58
19	18 10	18 10	18 10	18 10	18 10	18 10	18 10	18 11	18 11	18 11	18 11	18 11	18 11	18 11
23	18 14	18 15	18 15	18 16	18 16	18 17	18 17	18 18	18 19	18 20	18 21	18 22	18 23	18 24
27	18 19	18 19	18 20	18 21	18 22	18 23	18 24	18 26	18 27	18 29	18 30	18 32	18 35	18 37
31	18 23	18 24	18 25	18 26	18 28	18 29	18 31	18 33	18 35	18 37	18 40	18 43	18 46	18 50
Apr. 4	18 27	18 28	18 30	18 32	18 34	18 36	18 38	18 40	18 43	18 46	18 50	18 54	18 58	19 04

SUNRISE AND SUNSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 31	6 21	6 18	6 16	6 13	6 11	6 10	6 07	6 04	6 01	5 58	5 55	5 51	5 49	5 47
Apr. 4	6 29	6 24	6 21	6 17	6 15	6 12	6 08	6 04	6 00	5 56	5 52	5 47	5 44	5 40
8	6 37	6 31	6 26	6 21	6 18	6 14	6 09	6 04	5 59	5 54	5 48	5 42	5 38	5 34
12	6 44	6 37	6 31	6 25	6 21	6 17	6 10	6 04	5 58	5 51	5 45	5 37	5 33	5 28
16	6 52	6 43	6 36	6 29	6 24	6 19	6 11	6 04	5 57	5 49	5 42	5 33	5 28	5 22
20	7 00	6 49	6 41	6 33	6 27	6 22	6 12	6 04	5 56	5 47	5 39	5 28	5 23	5 16
24	7 07	6 55	6 45	6 37	6 30	6 24	6 13	6 04	5 55	5 46	5 36	5 24	5 18	5 10
28	7 15	7 01	6 50	6 41	6 34	6 27	6 15	6 04	5 54	5 44	5 33	5 20	5 13	5 05
May 2	7 22	7 07	6 55	6 45	6 37	6 29	6 16	6 05	5 54	5 43	5 31	5 17	5 09	5 00
6	7 30	7 13	7 00	6 49	6 40	6 32	6 18	6 05	5 53	5 41	5 28	5 13	5 05	4 55
10	7 37	7 19	7 05	6 53	6 43	6 34	6 19	6 06	5 53	5 40	5 26	5 10	5 01	4 50
14	7 44	7 25	7 09	6 57	6 46	6 37	6 21	6 06	5 53	5 39	5 25	5 08	4 58	4 46
18	7 51	7 30	7 14	7 01	6 49	6 39	6 22	6 07	5 53	5 38	5 23	5 05	4 55	4 43
22	7 57	7 35	7 18	7 04	6 52	6 42	6 24	6 08	5 53	5 38	5 22	5 03	4 52	4 39
26	8 03	7 40	7 22	7 07	6 55	6 44	6 25	6 09	5 53	5 38	5 21	5 01	4 50	4 37
30	8 09	7 44	7 26	7 11	6 58	6 46	6 27	6 10	5 54	5 38	5 20	5 00	4 48	4 34
June 3	8 13	7 48	7 29	7 13	7 00	6 48	6 28	6 11	5 54	5 38	5 20	4 59	4 47	4 33
7	8 18	7 52	7 32	7 16	7 02	6 50	6 30	6 12	5 55	5 38	5 20	4 58	4 46	4 31
11	8 21	7 55	7 35	7 18	7 04	6 52	6 31	6 13	5 56	5 39	5 20	4 58	4 45	4 31
15	8 24	7 57	7 37	7 20	7 06	6 54	6 32	6 14	5 57	5 39	5 20	4 58	4 45	4 30
19	8 26	7 59	7 38	7 21	7 07	6 55	6 34	6 15	5 58	5 40	5 21	4 59	4 46	4 31
23	8 27	8 00	7 39	7 22	7 08	6 56	6 34	6 16	5 58	5 41	5 22	5 00	4 47	4 32
27	8 27	8 00	7 39	7 23	7 09	6 56	6 35	6 17	5 59	5 42	5 23	5 01	4 48	4 33
July 1	8 26	8 00	7 39	7 23	7 09	6 57	6 36	6 17	6 00	5 43	5 24	5 02	4 49	4 34
5	8 24	7 58	7 38	7 22	7 08	6 56	6 36	6 18	6 01	5 44	5 25	5 04	4 51	4 37

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 31	17 46	17 50	17 52	17 55	17 57	17 58	18 02	18 05	18 08	18 11	18 14	18 18	18 20	18 23
Apr. 4	17 36	17 41	17 45	17 48	17 51	17 54	17 58	18 02	18 06	18 10	18 15	18 20	18 23	18 27
8	17 26	17 33	17 38	17 42	17 46	17 49	17 55	18 00	18 05	18 10	18 16	18 23	18 26	18 31
12	17 16	17 24	17 31	17 36	17 40	17 44	17 52	17 58	18 04	18 10	18 17	18 25	18 30	18 35
16	17 07	17 16	17 24	17 30	17 35	17 40	17 49	17 56	18 03	18 11	18 18	18 27	18 33	18 39
20	16 57	17 08	17 17	17 24	17 30	17 36	17 46	17 54	18 02	18 11	18 20	18 30	18 36	18 43
24	16 48	17 01	17 10	17 19	17 26	17 32	17 43	17 52	18 02	18 11	18 21	18 32	18 39	18 47
28	16 40	16 53	17 04	17 13	17 21	17 28	17 40	17 51	18 01	18 11	18 22	18 35	18 42	18 51
May 2	16 31	16 46	16 58	17 08	17 17	17 24	17 38	17 49	18 00	18 12	18 24	18 38	18 46	18 55
6	16 23	16 40	16 53	17 04	17 13	17 21	17 35	17 48	18 00	18 12	18 25	18 40	18 49	18 59
10	16 15	16 33	16 48	16 59	17 09	17 18	17 34	17 47	18 00	18 13	18 27	18 43	18 52	19 03
14	16 08	16 28	16 43	16 55	17 06	17 16	17 32	17 46	18 00	18 14	18 28	18 45	18 55	19 07
18	16 02	16 22	16 39	16 52	17 03	17 13	17 30	17 46	18 00	18 14	18 30	18 48	18 58	19 11
22	15 56	16 18	16 35	16 49	17 01	17 11	17 29	17 45	18 00	18 15	18 32	18 50	19 01	19 14
26	15 50	16 14	16 32	16 46	16 59	17 10	17 28	17 45	18 01	18 16	18 33	18 53	19 04	19 18
30	15 46	16 10	16 29	16 44	16 57	17 08	17 28	17 45	18 01	18 17	18 35	18 55	19 07	19 21
June 3	15 42	16 07	16 27	16 42	16 56	17 07	17 28	17 45	18 02	18 18	18 36	18 57	19 10	19 24
7	15 39	16 05	16 25	16 41	16 55	17 07	17 28	17 45	18 02	18 19	18 38	18 59	19 12	19 26
11	15 37	16 04	16 24	16 41	16 55	17 07	17 28	17 46	18 03	18 20	18 39	19 01	19 14	19 28
15	15 36	16 03	16 24	16 41	16 55	17 07	17 28	17 47	18 04	18 22	18 40	19 02	19 15	19 30
19	15 36	16 03	16 24	16 41	16 55	17 08	17 29	17 47	18 05	18 22	18 41	19 04	19 17	19 32
23	15 37	16 04	16 25	16 42	16 56	17 08	17 30	17 48	18 06	18 23	18 42	19 04	19 17	19 33
27	15 39	16 06	16 26	16 43	16 57	17 10	17 31	17 49	18 07	18 24	18 43	19 05	19 18	19 33
July 1	15 41	16 08	16 28	16 45	16 59	17 11	17 32	17 50	18 07	18 25	18 43	19 05	19 18	19 33
5	15 45	16 11	16 31	16 47	17 01	17 13	17 33	17 51	18 08	18 25	18 44	19 05	19 18	19 32

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 31	5 47	5 46	5 44	5 43	5 42	5 40	5 39	5 37	5 35	5 33	5 30	5 27	5 24	5 20
Apr. 4	5 40	5 39	5 37	5 35	5 34	5 32	5 29	5 27	5 24	5 21	5 18	5 14	5 10	5 05
8	5 34	5 32	5 30	5 28	5 26	5 23	5 20	5 17	5 14	5 10	5 06	5 01	4 56	4 49
12	5 28	5 25	5 23	5 20	5 18	5 15	5 11	5 08	5 04	4 59	4 54	4 48	4 42	4 34
16	5 22	5 19	5 16	5 13	5 10	5 06	5 02	4 58	4 53	4 48	4 42	4 35	4 27	4 18
20	5 16	5 13	5 10	5 06	5 02	4 58	4 54	4 49	4 43	4 37	4 31	4 23	4 13	4 03
24	5 10	5 07	5 03	4 59	4 55	4 50	4 45	4 40	4 34	4 27	4 19	4 10	4 00	3 47
28	5 05	5 01	4 57	4 53	4 48	4 43	4 37	4 31	4 24	4 17	4 08	3 58	3 46	3 31
May 2	5 00	4 55	4 51	4 46	4 41	4 36	4 30	4 23	4 15	4 07	3 57	3 45	3 32	3 16
6	4 55	4 50	4 46	4 40	4 35	4 29	4 22	4 15	4 06	3 57	3 46	3 33	3 18	3 00
10	4 50	4 46	4 40	4 35	4 29	4 22	4 15	4 07	3 58	3 48	3 36	3 22	3 05	2 44
14	4 46	4 41	4 36	4 30	4 23	4 16	4 09	4 00	3 50	3 39	3 26	3 11	2 52	2 28
18	4 43	4 37	4 31	4 25	4 18	4 11	4 03	3 53	3 43	3 31	3 17	3 00	2 39	2 12
22	4 39	4 34	4 28	4 21	4 14	4 06	3 57	3 47	3 36	3 23	3 08	2 50	2 27	1 56
26	4 37	4 31	4 24	4 17	4 10	4 02	3 52	3 42	3 30	3 16	3 00	2 40	2 15	1 40
30	4 34	4 28	4 22	4 14	4 07	3 58	3 48	3 37	3 25	3 10	2 53	2 32	2 04	1 23
June 3	4 33	4 26	4 19	4 12	4 04	3 55	3 45	3 33	3 20	3 05	2 47	2 25	1 54	1 06
7	4 31	4 25	4 18	4 10	4 02	3 53	3 42	3 30	3 17	3 01	2 42	2 18	1 46	0 47
11	4 31	4 24	4 17	4 09	4 00	3 51	3 40	3 28	3 15	2 58	2 39	2 14	1 38	0 25
15	4 30	4 24	4 16	4 09	4 00	3 50	3 39	3 27	3 13	2 57	2 36	2 10	1 34	** **
19	4 31	4 24	4 17	4 09	4 00	3 50	3 39	3 27	3 13	2 56	2 35	2 09	1 31	** **
23	4 32	4 25	4 17	4 09	4 01	3 51	3 40	3 28	3 13	2 57	2 36	2 10	1 31	** **
27	4 33	4 26	4 19	4 11	4 02	3 52	3 42	3 29	3 15	2 58	2 38	2 12	1 34	** **
July 1	4 34	4 28	4 21	4 13	4 04	3 55	3 44	3 32	3 18	3 01	2 41	2 16	1 40	0 11
5	4 37	4 30	4 23	4 15	4 07	3 57	3 47	3 35	3 21	3 05	2 46	2 22	1 48	0 44

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 31	18 23	18 24	18 25	18 26	18 28	18 29	18 31	18 33	18 35	18 37	18 40	18 43	18 46	18 50
Apr. 4	18 27	18 28	18 30	18 32	18 34	18 36	18 38	18 40	18 43	18 46	18 50	18 54	18 58	19 04
8	18 31	18 33	18 35	18 37	18 39	18 42	18 45	18 48	18 51	18 55	19 00	19 05	19 10	19 17
12	18 35	18 37	18 40	18 42	18 45	18 48	18 52	18 55	19 00	19 04	19 09	19 15	19 22	19 30
16	18 39	18 42	18 44	18 48	18 51	18 54	18 58	19 03	19 08	19 13	19 19	19 26	19 34	19 44
20	18 43	18 46	18 49	18 53	18 57	19 01	19 05	19 10	19 16	19 22	19 29	19 37	19 47	19 58
24	18 47	18 50	18 54	18 58	19 02	19 07	19 12	19 18	19 24	19 31	19 39	19 48	19 59	20 12
28	18 51	18 55	18 59	19 03	19 08	19 13	19 19	19 25	19 32	19 40	19 49	19 59	20 12	20 26
May 2	18 55	18 59	19 04	19 08	19 14	19 19	19 26	19 33	19 40	19 49	19 59	20 11	20 24	20 41
6	18 59	19 04	19 08	19 14	19 19	19 25	19 32	19 40	19 48	19 58	20 09	20 22	20 37	20 56
10	19 03	19 08	19 13	19 19	19 25	19 31	19 39	19 47	19 56	20 07	20 19	20 33	20 50	21 12
14	19 07	19 12	19 18	19 24	19 30	19 37	19 45	19 54	20 04	20 15	20 28	20 44	21 03	21 28
18	19 11	19 16	19 22	19 28	19 35	19 43	19 51	20 01	20 11	20 23	20 38	20 55	21 16	21 44
22	19 14	19 20	19 26	19 33	19 40	19 48	19 57	20 07	20 18	20 31	20 47	21 05	21 29	22 01
26	19 18	19 24	19 30	19 37	19 45	19 53	20 02	20 13	20 25	20 39	20 55	21 15	21 41	22 18
30	19 21	19 27	19 34	19 41	19 49	19 58	20 07	20 18	20 31	20 46	21 03	21 25	21 53	22 36
June 3	19 24	19 30	19 37	19 45	19 53	20 02	20 12	20 23	20 36	20 52	21 10	21 33	22 04	22 55
7	19 26	19 33	19 40	19 48	19 56	20 05	20 16	20 28	20 41	20 57	21 16	21 40	22 14	23 15
11	19 28	19 35	19 42	19 50	19 59	20 08	20 19	20 31	20 45	21 01	21 21	21 46	22 22	23 42
15	19 30	19 37	19 44	19 52	20 01	20 11	20 21	20 34	20 48	21 05	21 25	21 51	22 28	** **
19	19 32	19 38	19 46	19 54	20 03	20 12	20 23	20 36	20 50	21 07	21 27	21 54	22 32	** **
23	19 33	19 39	19 47	19 55	20 03	20 13	20 24	20 36	20 51	21 07	21 28	21 54	22 33	** **
27	19 33	19 40	19 47	19 55	20 04	20 13	20 24	20 36	20 50	21 07	21 27	21 53	22 31	** **
July 1	19 33	19 39	19 47	19 54	20 03	20 13	20 23	20 35	20 49	21 06	21 25	21 51	22 26	23 45
5	19 32	19 39	19 46	19 53	20 02	20 11	20 22	20 33	20 47	21 03	21 22	21 46	22 19	23 20

(** **) indicates Sun continuously above horizon.

SUNRISE AND SUNSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	8 26	8 00	7 39	7 23	7 09	6 57	6 36	6 17	6 00	5 43	5 24	5 02	4 49	4 34
5	8 24	7 58	7 38	7 22	7 08	6 56	6 36	6 18	6 01	5 44	5 25	5 04	4 51	4 37
9	8 22	7 56	7 37	7 21	7 08	6 56	6 36	6 18	6 01	5 45	5 27	5 06	4 53	4 39
13	8 18	7 54	7 35	7 19	7 06	6 55	6 35	6 18	6 02	5 46	5 28	5 08	4 56	4 42
17	8 14	7 50	7 32	7 17	7 05	6 54	6 35	6 18	6 02	5 47	5 30	5 10	4 58	4 45
21	8 09	7 46	7 29	7 15	7 03	6 52	6 34	6 18	6 03	5 48	5 31	5 12	5 01	4 48
25	8 03	7 42	7 25	7 12	7 00	6 50	6 33	6 17	6 03	5 48	5 33	5 14	5 04	4 51
29	7 56	7 37	7 21	7 08	6 57	6 48	6 31	6 17	6 03	5 49	5 34	5 17	5 07	4 55
Aug. 2	7 49	7 31	7 16	7 04	6 54	6 45	6 29	6 16	6 03	5 50	5 36	5 19	5 10	4 59
6	7 41	7 25	7 11	7 00	6 50	6 42	6 27	6 15	6 02	5 50	5 37	5 22	5 13	5 02
10	7 33	7 18	7 06	6 55	6 47	6 39	6 25	6 13	6 02	5 51	5 38	5 24	5 16	5 06
14	7 25	7 11	7 00	6 50	6 42	6 35	6 23	6 12	6 01	5 51	5 39	5 26	5 19	5 10
18	7 16	7 04	6 53	6 45	6 38	6 31	6 20	6 10	6 01	5 51	5 41	5 29	5 22	5 14
22	7 07	6 56	6 47	6 39	6 33	6 27	6 17	6 08	6 00	5 51	5 42	5 31	5 25	5 18
26	6 58	6 48	6 40	6 34	6 28	6 23	6 14	6 06	5 59	5 51	5 43	5 33	5 28	5 21
30	6 48	6 40	6 33	6 27	6 23	6 18	6 11	6 04	5 57	5 51	5 44	5 36	5 31	5 25
Sept. 3	6 38	6 31	6 26	6 21	6 17	6 14	6 07	6 02	5 56	5 51	5 45	5 38	5 34	5 29
7	6 28	6 23	6 19	6 15	6 12	6 09	6 04	5 59	5 55	5 50	5 46	5 40	5 37	5 33
11	6 18	6 14	6 11	6 08	6 06	6 04	6 00	5 57	5 54	5 50	5 46	5 42	5 39	5 37
15	6 08	6 06	6 04	6 02	6 00	5 59	5 57	5 54	5 52	5 50	5 47	5 44	5 42	5 40
19	5 58	5 57	5 56	5 55	5 55	5 54	5 53	5 52	5 51	5 49	5 48	5 46	5 45	5 44
23	5 47	5 48	5 48	5 49	5 49	5 49	5 49	5 49	5 49	5 49	5 49	5 49	5 48	5 48
27	5 37	5 39	5 41	5 42	5 43	5 44	5 46	5 47	5 48	5 49	5 50	5 51	5 51	5 52
Oct. 1	5 27	5 30	5 33	5 35	5 37	5 39	5 42	5 44	5 47	5 49	5 51	5 53	5 54	5 56
5	5 17	5 22	5 26	5 29	5 32	5 34	5 38	5 42	5 45	5 48	5 52	5 55	5 57	6 00

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	15 41	16 08	16 28	16 45	16 59	17 11	17 32	17 50	18 07	18 25	18 43	19 05	19 18	19 33
5	15 45	16 11	16 31	16 47	17 01	17 13	17 33	17 51	18 08	18 25	18 44	19 05	19 18	19 32
9	15 49	16 14	16 34	16 49	17 03	17 14	17 35	17 52	18 09	18 25	18 43	19 04	19 17	19 31
13	15 54	16 18	16 37	16 52	17 05	17 16	17 36	17 53	18 09	18 26	18 43	19 03	19 15	19 29
17	15 59	16 22	16 40	16 55	17 08	17 19	17 37	17 54	18 10	18 25	18 42	19 02	19 14	19 27
21	16 05	16 27	16 44	16 58	17 10	17 21	17 39	17 55	18 10	18 25	18 41	19 00	19 11	19 24
25	16 11	16 32	16 48	17 02	17 13	17 23	17 40	17 56	18 10	18 25	18 40	18 58	19 09	19 21
29	16 17	16 37	16 52	17 05	17 16	17 25	17 42	17 56	18 10	18 24	18 39	18 56	19 06	19 17
Aug. 2	16 24	16 42	16 57	17 09	17 19	17 28	17 43	17 57	18 10	18 23	18 37	18 53	19 02	19 13
6	16 31	16 48	17 01	17 12	17 22	17 30	17 45	17 57	18 09	18 22	18 35	18 50	18 59	19 09
10	16 38	16 53	17 06	17 16	17 25	17 32	17 46	17 58	18 09	18 20	18 32	18 46	18 55	19 04
14	16 45	16 59	17 10	17 20	17 28	17 35	17 47	17 58	18 08	18 19	18 30	18 43	18 50	18 59
18	16 53	17 05	17 15	17 23	17 31	17 37	17 48	17 58	18 07	18 17	18 27	18 39	18 46	18 53
22	17 00	17 11	17 20	17 27	17 34	17 39	17 49	17 58	18 06	18 15	18 24	18 35	18 41	18 48
26	17 07	17 17	17 24	17 31	17 36	17 41	17 50	17 58	18 05	18 13	18 21	18 30	18 36	18 42
30	17 14	17 22	17 29	17 35	17 39	17 44	17 51	17 58	18 04	18 10	18 17	18 26	18 30	18 36
Sept. 3	17 22	17 28	17 34	17 38	17 42	17 46	17 52	17 57	18 03	18 08	18 14	18 21	18 25	18 29
7	17 29	17 34	17 38	17 42	17 45	17 48	17 53	17 57	18 01	18 06	18 10	18 16	18 19	18 23
11	17 36	17 40	17 43	17 46	17 48	17 50	17 54	17 57	18 00	18 03	18 07	18 11	18 14	18 16
15	17 44	17 46	17 48	17 50	17 51	17 52	17 54	17 57	17 59	18 01	18 03	18 06	18 08	18 10
19	17 51	17 52	17 53	17 53	17 54	17 54	17 55	17 56	17 57	17 58	18 00	18 01	18 02	18 03
23	17 59	17 58	17 57	17 57	17 57	17 56	17 56	17 56	17 56	17 56	17 56	17 56	17 56	17 57
27	18 06	18 04	18 02	18 01	18 00	17 59	17 57	17 56	17 54	17 53	17 52	17 51	17 51	17 50
Oct. 1	18 14	18 10	18 07	18 05	18 03	18 01	17 58	17 55	17 53	17 51	17 49	17 46	17 45	17 43
5	18 22	18 16	18 12	18 09	18 06	18 03	17 59	17 55	17 52	17 49	17 45	17 41	17 39	17 37

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	4 34	4 28	4 21	4 13	4 04	3 55	3 44	3 32	3 18	3 01	2 41	2 16	1 40	0 11
5	4 37	4 30	4 23	4 15	4 07	3 57	3 47	3 35	3 21	3 05	2 46	2 22	1 48	0 44
9	4 39	4 33	4 26	4 18	4 10	4 01	3 51	3 39	3 26	3 10	2 52	2 29	1 57	1 05
13	4 42	4 36	4 29	4 21	4 13	4 05	3 55	3 44	3 31	3 16	2 59	2 37	2 08	1 24
17	4 45	4 39	4 32	4 25	4 18	4 09	4 00	3 49	3 37	3 23	3 06	2 46	2 20	1 42
21	4 48	4 42	4 36	4 29	4 22	4 14	4 05	3 55	3 43	3 30	3 14	2 56	2 32	1 59
25	4 51	4 46	4 40	4 34	4 27	4 19	4 10	4 01	3 50	3 38	3 23	3 06	2 44	2 15
29	4 55	4 50	4 44	4 38	4 31	4 24	4 16	4 07	3 57	3 46	3 32	3 16	2 57	2 31
Aug. 2	4 59	4 54	4 48	4 43	4 37	4 30	4 22	4 14	4 05	3 54	3 42	3 27	3 09	2 47
6	5 02	4 58	4 53	4 48	4 42	4 35	4 29	4 21	4 12	4 02	3 51	3 38	3 22	3 02
10	5 06	5 02	4 57	4 52	4 47	4 41	4 35	4 28	4 20	4 11	4 01	3 49	3 35	3 17
14	5 10	5 06	5 02	4 57	4 53	4 47	4 41	4 35	4 28	4 20	4 10	4 00	3 47	3 32
18	5 14	5 10	5 06	5 02	4 58	4 53	4 48	4 42	4 36	4 28	4 20	4 10	3 59	3 46
22	5 18	5 14	5 11	5 07	5 03	4 59	4 54	4 49	4 43	4 37	4 30	4 21	4 11	4 00
26	5 21	5 19	5 16	5 12	5 09	5 05	5 01	4 56	4 51	4 46	4 39	4 32	4 23	4 13
30	5 25	5 23	5 20	5 17	5 14	5 11	5 07	5 03	4 59	4 54	4 49	4 42	4 35	4 27
Sept. 3	5 29	5 27	5 25	5 22	5 20	5 17	5 14	5 11	5 07	5 03	4 58	4 53	4 47	4 40
7	5 33	5 31	5 29	5 27	5 25	5 23	5 20	5 18	5 15	5 11	5 08	5 03	4 58	4 53
11	5 37	5 35	5 34	5 32	5 31	5 29	5 27	5 25	5 23	5 20	5 17	5 14	5 10	5 05
15	5 40	5 39	5 38	5 37	5 36	5 35	5 34	5 32	5 30	5 28	5 26	5 24	5 21	5 18
19	5 44	5 44	5 43	5 42	5 42	5 41	5 40	5 39	5 38	5 37	5 36	5 34	5 33	5 31
23	5 48	5 48	5 48	5 47	5 47	5 47	5 47	5 46	5 46	5 46	5 45	5 45	5 44	5 43
27	5 52	5 52	5 52	5 52	5 53	5 53	5 53	5 54	5 54	5 54	5 55	5 55	5 55	5 56
Oct. 1	5 56	5 56	5 57	5 58	5 58	5 59	6 00	6 01	6 02	6 03	6 04	6 05	6 07	6 09
5	6 00	6 01	6 02	6 03	6 04	6 05	6 07	6 08	6 10	6 12	6 14	6 16	6 19	6 22

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	19 33	19 39	19 47	19 54	20 03	20 13	20 23	20 35	20 49	21 06	21 25	21 51	22 26	23 45
5	19 32	19 39	19 46	19 53	20 02	20 11	20 22	20 33	20 47	21 03	21 22	21 46	22 19	23 20
9	19 31	19 37	19 44	19 52	20 00	20 09	20 19	20 30	20 44	20 59	21 17	21 40	22 11	23 01
13	19 29	19 35	19 42	19 49	19 57	20 06	20 16	20 27	20 39	20 54	21 11	21 33	22 01	22 44
17	19 27	19 33	19 39	19 46	19 54	20 02	20 12	20 22	20 34	20 48	21 04	21 25	21 50	22 27
21	19 24	19 30	19 36	19 43	19 50	19 58	20 07	20 17	20 28	20 41	20 57	21 15	21 39	22 11
25	19 21	19 26	19 32	19 39	19 46	19 53	20 02	20 11	20 22	20 34	20 48	21 05	21 26	21 54
29	19 17	19 23	19 28	19 34	19 41	19 48	19 56	20 04	20 14	20 26	20 39	20 55	21 14	21 38
Aug. 2	19 13	19 18	19 23	19 29	19 35	19 42	19 49	19 57	20 07	20 17	20 29	20 44	21 01	21 22
6	19 09	19 13	19 18	19 23	19 29	19 35	19 42	19 50	19 58	20 08	20 19	20 32	20 47	21 07
10	19 04	19 08	19 13	19 18	19 23	19 28	19 35	19 42	19 50	19 58	20 08	20 20	20 34	20 51
14	18 59	19 03	19 07	19 11	19 16	19 21	19 27	19 33	19 40	19 48	19 57	20 08	20 20	20 35
18	18 53	18 57	19 01	19 05	19 09	19 14	19 19	19 25	19 31	19 38	19 46	19 56	20 06	20 19
22	18 48	18 51	18 54	18 58	19 02	19 06	19 10	19 16	19 21	19 28	19 35	19 43	19 52	20 04
26	18 42	18 44	18 47	18 51	18 54	18 58	19 02	19 06	19 11	19 17	19 23	19 30	19 38	19 48
30	18 36	18 38	18 41	18 43	18 46	18 49	18 53	18 57	19 01	19 06	19 11	19 17	19 24	19 33
Sept. 3	18 29	18 31	18 33	18 36	18 38	18 41	18 44	18 47	18 51	18 55	18 59	19 04	19 10	19 17
7	18 23	18 25	18 26	18 28	18 30	18 32	18 35	18 37	18 40	18 44	18 47	18 51	18 56	19 02
11	18 16	18 18	18 19	18 20	18 22	18 24	18 25	18 28	18 30	18 32	18 35	18 38	18 42	18 46
15	18 10	18 11	18 12	18 13	18 14	18 15	18 16	18 18	18 19	18 21	18 23	18 25	18 28	18 31
19	18 03	18 04	18 04	18 05	18 05	18 06	18 07	18 08	18 09	18 10	18 11	18 12	18 14	18 15
23	17 57	17 57	17 57	17 57	17 57	17 57	17 57	17 58	17 58	17 58	17 59	17 59	17 59	18 00
27	17 50	17 50	17 49	17 49	17 48	17 48	17 48	17 48	17 47	17 47	17 46	17 46	17 45	17 45
Oct. 1	17 43	17 43	17 42	17 41	17 41	17 40	17 39	17 38	17 37	17 36	17 34	17 33	17 31	17 29
5	17 37	17 36	17 35	17 34	17 32	17 31	17 30	17 28	17 26	17 24	17 22	17 20	17 17	17 14

SUNRISE AND SUNSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	5 27	5 30	5 33	5 35	5 37	5 39	5 42	5 44	5 47	5 49	5 51	5 53	5 54	5 56
5	5 17	5 22	5 26	5 29	5 32	5 34	5 38	5 42	5 45	5 48	5 52	5 55	5 57	6 00
9	5 07	5 13	5 18	5 23	5 26	5 30	5 35	5 40	5 44	5 48	5 53	5 58	6 00	6 04
13	4 57	5 05	5 11	5 16	5 21	5 25	5 32	5 38	5 43	5 48	5 54	6 00	6 04	6 08
17	4 47	4 56	5 04	5 10	5 16	5 20	5 29	5 36	5 42	5 49	5 55	6 03	6 07	6 12
21	4 37	4 48	4 57	5 04	5 11	5 16	5 26	5 34	5 41	5 49	5 57	6 05	6 11	6 16
25	4 28	4 40	4 51	4 59	5 06	5 12	5 23	5 32	5 41	5 49	5 58	6 08	6 14	6 21
29	4 19	4 33	4 44	4 54	5 01	5 08	5 20	5 31	5 40	5 50	6 00	6 11	6 18	6 25
Nov. 2	4 10	4 26	4 38	4 49	4 57	5 05	5 18	5 30	5 40	5 51	6 02	6 14	6 21	6 30
6	4 02	4 19	4 33	4 44	4 54	5 02	5 16	5 29	5 40	5 52	6 04	6 17	6 25	6 34
10	3 54	4 13	4 28	4 40	4 50	4 59	5 15	5 28	5 40	5 53	6 06	6 21	6 29	6 39
14	3 46	4 07	4 23	4 36	4 47	4 57	5 13	5 28	5 41	5 54	6 08	6 24	6 33	6 43
18	3 39	4 02	4 19	4 33	4 44	4 55	5 12	5 27	5 42	5 55	6 10	6 27	6 37	6 48
22	3 33	3 57	4 15	4 30	4 42	4 53	5 12	5 28	5 42	5 57	6 13	6 30	6 41	6 52
26	3 28	3 53	4 12	4 28	4 41	4 52	5 11	5 28	5 44	5 59	6 15	6 34	6 44	6 57
30	3 23	3 50	4 10	4 26	4 40	4 51	5 11	5 29	5 45	6 01	6 18	6 37	6 48	7 01
Dec. 4	3 20	3 47	4 08	4 25	4 39	4 51	5 12	5 30	5 46	6 03	6 20	6 40	6 52	7 05
8	3 17	3 46	4 07	4 25	4 39	4 51	5 13	5 31	5 48	6 05	6 23	6 43	6 55	7 09
12	3 16	3 45	4 07	4 25	4 39	4 52	5 14	5 33	5 50	6 07	6 25	6 46	6 58	7 12
16	3 15	3 45	4 08	4 25	4 40	4 53	5 15	5 34	5 52	6 09	6 27	6 49	7 01	7 15
20	3 16	3 46	4 09	4 27	4 42	4 55	5 17	5 36	5 54	6 11	6 30	6 51	7 03	7 17
24	3 18	3 48	4 11	4 29	4 44	4 57	5 19	5 38	5 56	6 13	6 32	6 53	7 05	7 19
28	3 21	3 51	4 13	4 31	4 46	4 59	5 21	5 40	5 58	6 15	6 33	6 55	7 07	7 21
32	3 25	3 55	4 17	4 34	4 49	5 02	5 24	5 42	6 00	6 17	6 35	6 56	7 08	7 22
36	3 30	3 59	4 20	4 38	4 52	5 05	5 26	5 44	6 01	6 18	6 36	6 57	7 09	7 22

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	18 14	18 10	18 07	18 05	18 03	18 01	17 58	17 55	17 53	17 51	17 49	17 46	17 45	17 43
5	18 22	18 16	18 12	18 09	18 06	18 03	17 59	17 55	17 52	17 49	17 45	17 41	17 39	17 37
9	18 29	18 23	18 17	18 13	18 09	18 06	18 00	17 55	17 51	17 46	17 42	17 37	17 34	17 31
13	18 37	18 29	18 23	18 17	18 12	18 08	18 01	17 55	17 50	17 44	17 38	17 32	17 28	17 24
17	18 45	18 36	18 28	18 21	18 16	18 11	18 03	17 55	17 49	17 42	17 35	17 28	17 23	17 18
21	18 54	18 42	18 33	18 26	18 19	18 14	18 04	17 56	17 48	17 40	17 33	17 24	17 18	17 13
25	19 02	18 49	18 39	18 30	18 23	18 17	18 06	17 56	17 48	17 39	17 30	17 20	17 14	17 07
29	19 10	18 56	18 44	18 35	18 27	18 20	18 07	17 57	17 47	17 38	17 27	17 16	17 09	17 02
Nov. 2	19 19	19 03	18 50	18 39	18 30	18 23	18 09	17 58	17 47	17 36	17 25	17 13	17 05	16 57
6	19 27	19 09	18 55	18 44	18 34	18 26	18 11	17 59	17 47	17 36	17 23	17 10	17 02	16 53
10	19 35	19 16	19 01	18 49	18 38	18 29	18 13	18 00	17 47	17 35	17 22	17 07	16 58	16 49
14	19 44	19 23	19 07	18 53	18 42	18 32	18 16	18 01	17 48	17 35	17 21	17 05	16 56	16 45
18	19 52	19 30	19 12	18 58	18 46	18 36	18 18	18 03	17 49	17 35	17 20	17 03	16 53	16 42
22	20 00	19 36	19 18	19 03	18 50	18 39	18 21	18 05	17 50	17 35	17 19	17 01	16 51	16 39
26	20 07	19 42	19 23	19 07	18 54	18 43	18 23	18 06	17 51	17 35	17 19	17 00	16 50	16 37
30	20 15	19 48	19 28	19 11	18 58	18 46	18 26	18 08	17 52	17 36	17 19	17 00	16 49	16 36
Dec. 4	20 21	19 53	19 32	19 15	19 01	18 49	18 28	18 10	17 54	17 37	17 20	17 00	16 48	16 35
8	20 27	19 58	19 37	19 19	19 05	18 52	18 31	18 12	17 55	17 39	17 21	17 00	16 48	16 35
12	20 32	20 02	19 40	19 23	19 08	18 55	18 33	18 15	17 57	17 40	17 22	17 01	16 49	16 35
16	20 36	20 06	19 43	19 26	19 11	18 58	18 36	18 17	17 59	17 42	17 23	17 02	16 50	16 36
20	20 39	20 09	19 46	19 28	19 13	19 00	18 38	18 19	18 01	17 44	17 25	17 04	16 51	16 37
24	20 41	20 11	19 48	19 30	19 15	19 02	18 40	18 21	18 03	17 46	17 27	17 06	16 54	16 39
28	20 41	20 12	19 49	19 31	19 16	19 03	18 41	18 23	18 05	17 48	17 29	17 08	16 56	16 42
32	20 41	20 12	19 50	19 32	19 17	19 05	18 43	18 24	18 07	17 50	17 32	17 11	16 59	16 45
36	20 39	20 11	19 49	19 32	19 18	19 05	18 44	18 26	18 09	17 52	17 34	17 14	17 02	16 48

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	5 56	5 56	5 57	5 58	5 58	5 59	6 00	6 01	6 02	6 03	6 04	6 05	6 07	6 09
5	6 00	6 01	6 02	6 03	6 04	6 05	6 07	6 08	6 10	6 12	6 14	6 16	6 19	6 22
9	6 04	6 05	6 06	6 08	6 10	6 11	6 13	6 15	6 18	6 20	6 23	6 27	6 30	6 35
13	6 08	6 09	6 11	6 13	6 15	6 18	6 20	6 23	6 26	6 29	6 33	6 37	6 42	6 48
17	6 12	6 14	6 16	6 19	6 21	6 24	6 27	6 31	6 34	6 38	6 43	6 48	6 54	7 01
21	6 16	6 19	6 21	6 24	6 27	6 31	6 34	6 38	6 43	6 47	6 53	6 59	7 06	7 15
25	6 21	6 23	6 26	6 30	6 33	6 37	6 41	6 46	6 51	6 57	7 03	7 10	7 19	7 28
29	6 25	6 28	6 32	6 35	6 39	6 44	6 48	6 54	6 59	7 06	7 13	7 21	7 31	7 42
Nov. 2	6 30	6 33	6 37	6 41	6 46	6 50	6 56	7 01	7 08	7 15	7 23	7 33	7 44	7 57
6	6 34	6 38	6 42	6 47	6 52	6 57	7 03	7 09	7 16	7 24	7 34	7 44	7 57	8 11
10	6 39	6 43	6 48	6 53	6 58	7 04	7 10	7 17	7 25	7 34	7 44	7 56	8 10	8 26
14	6 43	6 48	6 53	6 58	7 04	7 10	7 17	7 25	7 33	7 43	7 54	8 07	8 22	8 41
18	6 48	6 53	6 58	7 04	7 10	7 17	7 24	7 32	7 42	7 52	8 04	8 18	8 35	8 57
22	6 52	6 58	7 03	7 09	7 16	7 23	7 31	7 40	7 50	8 01	8 14	8 29	8 48	9 12
26	6 57	7 02	7 08	7 15	7 21	7 29	7 37	7 47	7 57	8 09	8 23	8 40	9 00	9 27
30	7 01	7 07	7 13	7 20	7 27	7 35	7 43	7 53	8 04	8 17	8 32	8 50	9 12	9 42
Dec. 4	7 05	7 11	7 17	7 24	7 32	7 40	7 49	7 59	8 11	8 24	8 40	8 59	9 23	9 56
8	7 09	7 15	7 21	7 28	7 36	7 45	7 54	8 05	8 17	8 31	8 47	9 07	9 32	10 08
12	7 12	7 18	7 25	7 32	7 40	7 49	7 58	8 09	8 22	8 36	8 53	9 14	9 41	10 20
16	7 15	7 21	7 28	7 35	7 44	7 52	8 02	8 13	8 26	8 40	8 58	9 19	9 47	10 28
20	7 17	7 24	7 31	7 38	7 46	7 55	8 05	8 16	8 29	8 44	9 01	9 23	9 51	10 34
24	7 19	7 26	7 33	7 40	7 48	7 57	8 07	8 18	8 31	8 46	9 03	9 25	9 53	10 36
28	7 21	7 27	7 34	7 41	7 49	7 58	8 08	8 19	8 32	8 46	9 04	9 25	9 53	10 34
32	7 22	7 28	7 35	7 42	7 50	7 59	8 08	8 19	8 31	8 46	9 03	9 23	9 50	10 29
36	7 22	7 28	7 35	7 42	7 50	7 58	8 08	8 18	8 30	8 44	9 00	9 20	9 46	10 21

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	17 43	17 43	17 42	17 41	17 41	17 40	17 39	17 38	17 37	17 36	17 34	17 33	17 31	17 29
5	17 37	17 36	17 35	17 34	17 32	17 31	17 30	17 28	17 26	17 24	17 22	17 20	17 17	17 14
9	17 31	17 29	17 28	17 26	17 24	17 23	17 21	17 18	17 16	17 13	17 10	17 07	17 03	16 59
13	17 24	17 23	17 21	17 19	17 17	17 14	17 12	17 09	17 06	17 02	16 59	16 54	16 49	16 44
17	17 18	17 16	17 14	17 12	17 09	17 06	17 03	17 00	16 56	16 52	16 47	16 42	16 36	16 29
21	17 13	17 10	17 07	17 05	17 01	16 58	16 54	16 50	16 46	16 41	16 36	16 29	16 22	16 14
25	17 07	17 04	17 01	16 58	16 54	16 50	16 46	16 42	16 36	16 31	16 24	16 17	16 09	15 59
29	17 02	16 59	16 55	16 51	16 47	16 43	16 38	16 33	16 27	16 21	16 13	16 05	15 55	15 44
Nov. 2	16 57	16 54	16 50	16 45	16 41	16 36	16 31	16 25	16 18	16 11	16 03	15 53	15 42	15 29
6	16 53	16 49	16 44	16 40	16 35	16 30	16 24	16 17	16 10	16 02	15 53	15 42	15 30	15 15
10	16 49	16 44	16 40	16 35	16 29	16 24	16 17	16 10	16 02	15 53	15 43	15 31	15 17	15 00
14	16 45	16 40	16 35	16 30	16 24	16 18	16 11	16 03	15 55	15 45	15 34	15 21	15 05	14 46
18	16 42	16 37	16 32	16 26	16 20	16 13	16 06	15 57	15 48	15 38	15 25	15 11	14 54	14 33
22	16 39	16 34	16 28	16 22	16 16	16 09	16 01	15 52	15 42	15 31	15 18	15 02	14 43	14 20
26	16 37	16 32	16 26	16 19	16 13	16 05	15 57	15 47	15 37	15 25	15 11	14 54	14 33	14 07
30	16 36	16 30	16 24	16 17	16 10	16 02	15 53	15 43	15 32	15 20	15 05	14 47	14 25	13 55
Dec. 4	16 35	16 29	16 23	16 16	16 08	16 00	15 51	15 41	15 29	15 16	15 00	14 41	14 17	13 44
8	16 35	16 28	16 22	16 15	16 07	15 59	15 49	15 39	15 27	15 13	14 56	14 36	14 11	13 35
12	16 35	16 29	16 22	16 15	16 07	15 58	15 48	15 38	15 25	15 11	14 54	14 33	14 06	13 27
16	16 36	16 29	16 23	16 15	16 07	15 58	15 49	15 38	15 25	15 10	14 53	14 32	14 04	13 23
20	16 37	16 31	16 24	16 17	16 09	16 00	15 50	15 39	15 26	15 11	14 54	14 32	14 04	13 21
24	16 39	16 33	16 26	16 19	16 11	16 02	15 52	15 41	15 28	15 13	14 56	14 34	14 06	13 23
28	16 42	16 36	16 29	16 21	16 13	16 05	15 55	15 44	15 31	15 17	14 59	14 38	14 10	13 29
32	16 45	16 39	16 32	16 25	16 17	16 08	15 58	15 48	15 35	15 21	15 04	14 43	14 17	13 38
36	16 48	16 42	16 36	16 29	16 21	16 12	16 03	15 52	15 40	15 27	15 10	14 50	14 25	13 49

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	20 54	20 21	19 57	19 38	19 22	19 07	18 43	18 22	18 03	17 43	17 22	16 58	16 44	16 27
	1	21 25	21 00	20 41	20 25	20 11	20 00	19 40	19 22	19 06	18 49	18 31	18 11	17 59	17 45
	2	21 45	21 28	21 14	21 03	20 53	20 44	20 29	20 16	20 03	19 51	19 37	19 22	19 13	19 03
	3	22 00	21 49	21 41	21 34	21 27	21 22	21 12	21 04	20 56	20 48	20 39	20 29	20 24	20 17
	4	22 12	22 07	22 03	22 00	21 58	21 55	21 51	21 47	21 44	21 41	21 37	21 33	21 30	21 28
	5	22 22	22 23	22 24	22 25	22 26	22 26	22 27	22 28	22 29	22 30	22 32	22 33	22 34	22 35
	6	22 32	22 39	22 44	22 49	22 53	22 56	23 03	23 08	23 13	23 19	23 24	23 31	23 35	23 39
	7	22 43	22 55	23 05	23 13	23 21	23 27	23 38	23 48	23 57	.. ..	.. ..	.. ..	.. ..	.. ..
	8	22 55	23 14	23 28	23 40	23 50	23 59	.. ..	.. ..	.. ..	0 06	0 16	0 28	0 35	0 42
	9	23 12	23 36	23 55	.. ..	.. ..	.. ..	0 15	0 28	0 41	0 54	1 08	1 24	1 34	1 45
	10	23 34	.. ..	.. ..	0 10	0 23	0 34	0 54	1 11	1 27	1 43	2 01	2 21	2 33	2 46
	11	.. ..	0 04	0 26	0 45	1 00	1 13	1 36	1 56	2 15	2 33	2 53	3 17	3 30	3 46
	12	0 05	0 40	1 05	1 25	1 42	1 57	2 22	2 44	3 04	3 24	3 46	4 11	4 26	4 43
	13	0 49	1 25	1 52	2 13	2 30	2 46	3 11	3 34	3 54	4 15	4 37	5 03	5 18	5 36
	14	1 45	2 20	2 46	3 07	3 24	3 38	4 03	4 25	4 45	5 05	5 26	5 51	6 06	6 22
	15	2 53	3 24	3 47	4 05	4 21	4 34	4 57	5 16	5 34	5 53	6 12	6 34	6 48	7 03
	16	4 08	4 33	4 52	5 07	5 20	5 31	5 50	6 07	6 23	6 38	6 55	7 14	7 24	7 37
	17	5 26	5 44	5 58	6 10	6 20	6 29	6 44	6 57	7 09	7 21	7 34	7 49	7 57	8 07
	18	6 44	6 56	7 05	7 13	7 20	7 26	7 36	7 45	7 54	8 02	8 11	8 21	8 27	8 33
	19	8 02	8 08	8 13	8 17	8 20	8 23	8 28	8 33	8 37	8 42	8 46	8 51	8 54	8 57
	20	9 21	9 21	9 21	9 21	9 21	9 21	9 21	9 21	9 21	9 21	9 21	9 21	9 21	9 21
	21	10 41	10 35	10 30	10 26	10 22	10 19	10 14	10 09	10 05	10 01	9 56	9 51	9 48	9 45
	22	12 04	11 52	11 42	11 33	11 26	11 20	11 09	11 00	10 51	10 43	10 34	10 24	10 18	10 11
	23	13 31	13 12	12 56	12 44	12 33	12 24	12 08	11 54	11 41	11 28	11 15	11 00	10 51	10 41
	24	15 01	14 34	14 13	13 57	13 42	13 30	13 10	12 52	12 35	12 19	12 01	11 41	11 30	11 16

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	2 23	3 00	3 26	3 48	4 05	4 20	4 46	5 08	5 29	5 49	6 11	6 36	6 51	7 08
	1	3 51	4 22	4 45	5 04	5 19	5 33	5 55	6 15	6 33	6 51	7 11	7 33	7 46	8 01
	2	5 27	5 50	6 08	6 22	6 35	6 45	7 03	7 19	7 34	7 48	8 04	8 21	8 31	8 43
	3	7 01	7 17	7 29	7 39	7 47	7 55	8 07	8 19	8 29	8 39	8 50	9 02	9 09	9 17
	4	8 31	8 39	8 46	8 51	8 56	9 00	9 07	9 13	9 19	9 25	9 31	9 38	9 41	9 46
	5	9 56	9 57	9 59	10 00	10 01	10 02	10 03	10 05	10 06	10 07	10 08	10 10	10 11	10 11
	6	11 16	11 12	11 09	11 06	11 03	11 01	10 57	10 54	10 51	10 47	10 44	10 40	10 38	10 36
	7	12 35	12 25	12 16	12 09	12 04	11 58	11 49	11 42	11 34	11 27	11 19	11 10	11 05	11 00
	8	13 53	13 36	13 23	13 12	13 03	12 55	12 41	12 29	12 18	12 07	11 55	11 42	11 34	11 25
	9	15 09	14 46	14 29	14 14	14 02	13 52	13 34	13 18	13 03	12 49	12 33	12 15	12 05	11 53
	10	16 23	15 55	15 33	15 15	15 01	14 48	14 26	14 07	13 50	13 32	13 14	12 52	12 40	12 26
	11	17 33	16 59	16 34	16 14	15 58	15 43	15 19	14 58	14 38	14 19	13 58	13 34	13 20	13 03
	12	18 33	17 57	17 30	17 09	16 52	16 36	16 11	15 49	15 28	15 08	14 45	14 20	14 05	13 47
	13	19 21	18 46	18 20	17 59	17 41	17 27	17 01	16 39	16 19	15 58	15 36	15 10	14 55	14 38
	14	19 56	19 25	19 01	18 42	18 26	18 12	17 49	17 28	17 09	16 50	16 29	16 05	15 51	15 34
	15	20 21	19 56	19 36	19 19	19 06	18 54	18 33	18 15	17 58	17 41	17 23	17 01	16 49	16 35
	16	20 40	20 20	20 04	19 51	19 40	19 31	19 14	18 59	18 45	18 31	18 16	17 59	17 49	17 37
	17	20 54	20 40	20 28	20 19	20 11	20 04	19 52	19 41	19 31	19 20	19 09	18 56	18 49	18 41
	18	21 05	20 57	20 50	20 44	20 39	20 35	20 28	20 21	20 15	20 08	20 01	19 54	19 49	19 44
	19	21 15	21 12	21 10	21 08	21 06	21 05	21 02	21 00	20 58	20 56	20 53	20 51	20 49	20 47
	20	21 25	21 27	21 30	21 32	21 33	21 35	21 37	21 40	21 42	21 44	21 46	21 49	21 50	21 52
	21	21 35	21 44	21 51	21 56	22 01	22 06	22 14	22 20	22 27	22 33	22 40	22 48	22 53	22 58
	22	21 47	22 02	22 14	22 24	22 32	22 40	22 53	23 04	23 15	23 25	23 37	23 50	23 58	.. ..
	23	22 04	22 25	22 42	22 56	23 08	23 18	23 36	23 52	.. ..	.. ..	.. ..	.. ..	.. ..	0 07
	24	22 27	22 56	23 18	23 35	23 50	.. ..	.. ..	.. ..	0 06	0 21	0 37	0 55	1 06	1 18

(.. ..) indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	16 27	16 20	16 12	16 03	15 53	15 43	15 30	15 17	15 01	14 41	14 18	13 46	12 54	** **
	1	17 45	17 39	17 32	17 25	17 17	17 08	16 59	16 48	16 35	16 21	16 04	15 42	15 15	14 35
	2	19 03	18 58	18 53	18 48	18 42	18 36	18 29	18 21	18 13	18 03	17 52	17 38	17 22	17 03
	3	20 17	20 14	20 11	20 08	20 04	20 01	19 56	19 52	19 46	19 41	19 34	19 26	19 18	19 07
	4	21 28	21 26	21 25	21 24	21 22	21 21	21 19	21 17	21 15	21 12	21 10	21 07	21 03	20 59
	5	22 35	22 35	22 35	22 36	22 36	22 37	22 37	22 38	22 39	22 39	22 40	22 41	22 42	22 44
	6	23 39	23 41	23 43	23 45	23 48	23 50	23 53	23 56	23 59	.. ..	.. ..	.. ..	.. ..	.. ..
	7	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 03	0 08	0 13	0 18	0 25
	8	0 42	0 46	0 49	0 53	0 57	1 02	1 07	1 13	1 19	1 26	1 34	1 43	1 54	2 07
	9	1 45	1 49	1 54	2 00	2 06	2 13	2 20	2 28	2 37	2 48	3 00	3 14	3 31	3 53
	10	2 46	2 52	2 59	3 06	3 14	3 22	3 32	3 43	3 55	4 09	4 26	4 46	5 13	5 51
	11	3 46	3 53	4 01	4 10	4 19	4 29	4 41	4 54	5 09	5 27	5 49	6 18	7 01	-- --
	12	4 43	4 51	5 00	5 09	5 19	5 31	5 43	5 58	6 15	6 36	7 03	7 41	-- --	-- --
	13	5 36	5 44	5 53	6 02	6 12	6 24	6 37	6 52	7 10	7 31	7 59	8 38	-- --	-- --
	14	6 22	6 30	6 38	6 47	6 57	7 08	7 20	7 34	7 50	8 10	8 34	9 06	9 59	-- --
	15	7 03	7 09	7 17	7 25	7 33	7 43	7 53	8 05	8 19	8 34	8 53	9 17	9 48	10 37
	16	7 37	7 43	7 49	7 55	8 02	8 10	8 18	8 28	8 38	8 50	9 04	9 21	9 41	10 07
	17	8 07	8 11	8 16	8 21	8 26	8 32	8 38	8 45	8 53	9 01	9 11	9 23	9 36	9 52
	18	8 33	8 36	8 39	8 42	8 46	8 50	8 54	8 59	9 04	9 09	9 16	9 23	9 31	9 41
	19	8 57	8 59	9 01	9 02	9 04	9 06	9 08	9 10	9 13	9 16	9 19	9 22	9 26	9 31
	20	9 21	9 21	9 21	9 21	9 21	9 21	9 21	9 21	9 21	9 21	9 22	9 22	9 22	9 22
	21	9 45	9 44	9 42	9 40	9 39	9 37	9 35	9 33	9 30	9 27	9 24	9 21	9 17	9 13
	22	10 11	10 08	10 05	10 02	9 58	9 54	9 50	9 45	9 40	9 35	9 28	9 21	9 13	9 03
	23	10 41	10 36	10 32	10 26	10 21	10 15	10 08	10 01	9 53	9 44	9 34	9 22	9 08	8 51
	24	11 16	11 11	11 04	10 57	10 50	10 42	10 33	10 23	10 11	9 58	9 43	9 25	9 03	8 34

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	7 08	7 15	7 24	7 33	7 43	7 54	8 06	8 20	8 36	8 56	9 20	9 52	10 44	** **
	1	8 01	8 07	8 14	8 22	8 30	8 40	8 50	9 01	9 14	9 29	9 47	10 09	10 37	11 18
	2	8 43	8 48	8 53	8 59	9 06	9 13	9 20	9 29	9 38	9 49	10 01	10 15	10 32	10 53
	3	9 17	9 20	9 24	9 28	9 32	9 37	9 42	9 48	9 54	10 01	10 09	10 17	10 28	10 40
	4	9 46	9 48	9 50	9 52	9 54	9 57	9 59	10 02	10 06	10 09	10 13	10 18	10 23	10 29
	5	10 11	10 12	10 12	10 13	10 13	10 14	10 14	10 15	10 15	10 16	10 17	10 18	10 19	10 20
	6	10 36	10 34	10 33	10 32	10 31	10 29	10 28	10 26	10 24	10 22	10 20	10 17	10 14	10 11
	7	11 00	10 57	10 54	10 52	10 49	10 45	10 42	10 38	10 33	10 28	10 23	10 17	10 10	10 01
	8	11 25	11 21	11 17	11 13	11 08	11 03	10 57	10 50	10 43	10 36	10 27	10 17	10 05	9 51
	9	11 53	11 48	11 42	11 36	11 30	11 23	11 15	11 06	10 56	10 45	10 33	10 18	10 00	9 37
	10	12 26	12 19	12 12	12 05	11 57	11 48	11 38	11 27	11 14	10 59	10 42	10 21	9 54	9 15
	11	13 03	12 56	12 48	12 39	12 30	12 19	12 07	11 54	11 39	11 20	10 58	10 29	9 45	-- --
	12	13 47	13 39	13 31	13 21	13 11	13 00	12 47	12 32	12 14	11 53	11 27	10 49	-- --	-- --
	13	14 38	14 30	14 21	14 12	14 01	13 50	13 37	13 22	13 04	12 43	12 15	11 36	-- --	-- --
	14	15 34	15 27	15 19	15 10	15 00	14 50	14 38	14 24	14 08	13 49	13 25	12 53	12 00	-- --
	15	16 35	16 28	16 21	16 14	16 05	15 56	15 46	15 35	15 21	15 06	14 48	14 25	13 54	13 06
	16	17 37	17 32	17 26	17 20	17 14	17 07	16 59	16 50	16 40	16 28	16 15	15 59	15 40	15 15
	17	18 41	18 37	18 33	18 28	18 24	18 18	18 13	18 07	18 00	17 52	17 43	17 32	17 20	17 05
	18	19 44	19 42	19 39	19 36	19 34	19 30	19 27	19 23	19 19	19 15	19 09	19 03	18 56	18 48
	19	20 47	20 47	20 46	20 45	20 44	20 43	20 42	20 40	20 39	20 37	20 36	20 34	20 31	20 29
	20	21 52	21 52	21 53	21 54	21 55	21 56	21 57	21 58	22 00	22 01	22 03	22 04	22 07	22 09
	21	22 58	23 00	23 03	23 05	23 08	23 11	23 15	23 18	23 22	23 27	23 32	23 38	23 45	23 53
	22	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
	23	0 07	0 10	0 15	0 19	0 24	0 29	0 35	0 42	0 49	0 57	1 06	1 17	1 30	1 45
	24	1 18	1 24	1 29	1 36	1 43	1 50	1 59	2 08	2 19	2 31	2 46	3 03	3 24	3 52

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	23	13 31	13 12	12 56	12 44	12 33	12 24	12 08	11 54	11 41	11 28	11 15	11 00	10 51	10 41
	24	15 01	14 34	14 13	13 57	13 42	13 30	13 10	12 52	12 35	12 19	12 01	11 41	11 30	11 16
	25	16 29	15 55	15 30	15 10	14 53	14 39	14 14	13 54	13 34	13 15	12 54	12 30	12 17	12 01
	26	17 46	17 08	16 41	16 19	16 02	15 46	15 20	14 58	14 37	14 16	13 54	13 28	13 13	12 55
	27	18 43	18 08	17 42	17 21	17 04	16 49	16 24	16 02	15 41	15 21	14 59	14 34	14 19	14 01
	28	19 22	18 53	18 31	18 13	17 58	17 45	17 22	17 03	16 45	16 26	16 07	15 44	15 31	15 15
	29	19 47	19 26	19 09	18 55	18 43	18 33	18 15	17 59	17 45	17 30	17 14	16 56	16 45	16 33
	30	20 04	19 50	19 39	19 29	19 21	19 14	19 01	18 50	18 40	18 29	18 18	18 06	17 58	17 50
	31	20 18	20 10	20 04	19 59	19 54	19 50	19 43	19 37	19 31	19 25	19 19	19 12	19 08	19 03
Feb.	1	20 29	20 27	20 26	20 25	20 24	20 23	20 22	20 20	20 19	20 18	20 17	20 15	20 14	20 14
	2	20 39	20 43	20 47	20 50	20 52	20 54	20 58	21 02	21 05	21 08	21 12	21 16	21 18	21 21
	3	20 50	21 00	21 08	21 15	21 20	21 26	21 35	21 42	21 50	21 58	22 06	22 15	22 20	22 27
	4	21 02	21 18	21 30	21 41	21 50	21 58	22 12	22 24	22 35	22 47	22 59	23 13	23 22	23 31
	5	21 17	21 39	21 56	22 10	22 22	22 32	22 50	23 06	23 21	23 36	23 52	.. ..	.. ..	.. ..
	6	21 37	22 05	22 26	22 43	22 58	23 10	23 32	23 51	.. ..	.. ..	.. ..	0 11	0 22	0 34
	7	22 05	22 38	23 02	23 22	23 38	23 53	.. ..	.. ..	0 09	0 26	0 46	1 08	1 21	1 36
	8	22 44	23 19	23 46	.. ..	.. ..	.. ..	0 17	0 38	0 58	1 17	1 39	2 03	2 18	2 35
	9	23 35	.. ..	.. ..	0 07	0 24	0 39	1 05	1 27	1 48	2 08	2 30	2 56	3 11	3 29
	10	.. ..	0 11	0 37	0 58	1 15	1 30	1 56	2 18	2 38	2 59	3 20	3 46	4 01	4 18
	11	0 39	1 12	1 36	1 55	2 11	2 25	2 49	3 09	3 28	3 47	4 07	4 31	4 45	5 00
	12	1 52	2 19	2 39	2 56	3 10	3 22	3 43	4 00	4 17	4 34	4 51	5 12	5 23	5 37
	13	3 09	3 30	3 46	3 59	4 10	4 20	4 36	4 51	5 04	5 18	5 32	5 48	5 58	6 09
	14	4 28	4 42	4 54	5 03	5 11	5 18	5 30	5 40	5 50	6 00	6 10	6 22	6 29	6 36
	15	5 47	5 55	6 02	6 07	6 12	6 16	6 23	6 29	6 35	6 40	6 47	6 53	6 57	7 02
	16	7 07	7 09	7 11	7 12	7 13	7 14	7 16	7 18	7 19	7 20	7 22	7 24	7 25	7 26

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
															0 07
Jan.	23	22 04	22 25	22 42	22 56	23 08	23 18	23 36	23 52	.. ..	.. ..	.. ..	.. ..	.. ..	
	24	22 27	22 56	23 18	23 35	23 50	.. ..	.. ..	.. ..	0 06	0 21	0 37	0 55	1 06	1 18
	25	23 03	23 38	.. ..	.. ..	.. ..	0 03	0 25	0 45	1 03	1 21	1 40	2 03	2 16	2 31
	26	23 59	.. ..	0 04	0 24	0 42	0 56	1 22	1 43	2 04	2 24	2 46	3 11	3 26	3 43
	27	.. ..	0 36	1 03	1 25	1 43	1 58	2 24	2 47	3 08	3 28	3 51	4 17	4 32	4 49
	28	1 15	1 50	2 15	2 35	2 52	3 07	3 31	3 52	4 12	4 31	4 52	5 16	5 30	5 46
	29	2 47	3 14	3 35	3 52	4 06	4 18	4 39	4 57	5 14	5 30	5 48	6 08	6 20	6 33
	30	4 22	4 42	4 57	5 10	5 20	5 29	5 45	5 59	6 11	6 24	6 37	6 52	7 01	7 11
	31	5 56	6 08	6 17	6 25	6 32	6 38	6 48	6 57	7 05	7 13	7 21	7 31	7 36	7 43
Feb.	1	7 25	7 30	7 34	7 37	7 40	7 43	7 47	7 51	7 54	7 58	8 01	8 05	8 08	8 10
	2	8 50	8 48	8 47	8 46	8 45	8 45	8 43	8 42	8 41	8 40	8 39	8 37	8 37	8 36
	3	10 12	10 04	9 58	9 53	9 48	9 44	9 38	9 32	9 26	9 21	9 15	9 09	9 05	9 01
	4	11 32	11 18	11 07	10 58	10 50	10 43	10 31	10 21	10 12	10 02	9 52	9 40	9 34	9 26
	5	12 51	12 30	12 14	12 02	11 51	11 41	11 25	11 10	10 57	10 44	10 30	10 14	10 04	9 54
	6	14 07	13 41	13 20	13 04	12 50	12 38	12 18	12 00	11 44	11 27	11 10	10 50	10 38	10 25
	7	15 20	14 48	14 24	14 04	13 48	13 35	13 11	12 51	12 32	12 13	11 53	11 30	11 16	11 01
	8	16 24	15 48	15 22	15 01	14 44	14 29	14 04	13 42	13 22	13 01	12 40	12 14	12 00	11 42
	9	17 17	16 41	16 14	15 53	15 36	15 20	14 55	14 33	14 12	13 51	13 29	13 03	12 48	12 30
	10	17 56	17 23	16 59	16 39	16 22	16 08	15 43	15 22	15 02	14 43	14 21	13 56	13 42	13 25
	11	18 25	17 57	17 36	17 18	17 04	16 51	16 29	16 10	15 52	15 34	15 15	14 52	14 39	14 24
	12	18 46	18 24	18 06	17 52	17 40	17 29	17 11	16 55	16 40	16 25	16 09	15 50	15 39	15 26
	13	19 01	18 45	18 32	18 22	18 13	18 05	17 50	17 38	17 27	17 15	17 02	16 48	16 39	16 30
	14	19 14	19 03	18 55	18 48	18 42	18 37	18 28	18 19	18 12	18 04	17 55	17 46	17 40	17 34
	15	19 24	19 20	19 16	19 13	19 10	19 08	19 03	19 00	18 56	18 52	18 48	18 44	18 41	18 38
	16	19 34	19 35	19 36	19 37	19 37	19 38	19 39	19 39	19 40	19 41	19 42	19 42	19 43	19 43

(.. ..) indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	23	10 41	10 36	10 32	10 26	10 21	10 15	10 08	10 01	9 53	9 44	9 34	9 22	9 08	8 51
	24	11 16	11 11	11 04	10 57	10 50	10 42	10 33	10 23	10 11	9 58	9 43	9 25	9 03	8 34
	25	12 01	11 53	11 46	11 37	11 28	11 18	11 07	10 54	10 39	10 22	10 01	9 34	8 58	7 41
	26	12 55	12 47	12 39	12 30	12 19	12 08	11 55	11 40	11 23	11 02	10 36	10 00	8 45	** **
	27	14 01	13 53	13 45	13 36	13 25	13 14	13 01	12 46	12 29	12 09	11 42	11 06	9 43	** **
	28	15 15	15 08	15 01	14 53	14 44	14 34	14 23	14 10	13 56	13 39	13 18	12 51	12 14	** **
	29	16 33	16 27	16 21	16 15	16 08	16 01	15 52	15 43	15 32	15 20	15 05	14 48	14 27	13 59
	30	17 50	17 46	17 42	17 37	17 33	17 27	17 22	17 15	17 08	17 01	16 52	16 41	16 29	16 14
	31	19 03	19 01	18 59	18 57	18 54	18 51	18 48	18 45	18 41	18 37	18 32	18 27	18 21	18 14
Feb.	1	20 14	20 13	20 13	20 12	20 12	20 11	20 11	20 10	20 09	20 09	20 08	20 07	20 06	20 04
	2	21 21	21 22	21 24	21 25	21 26	21 28	21 30	21 32	21 34	21 36	21 39	21 42	21 46	21 50
	3	22 27	22 29	22 32	22 36	22 39	22 43	22 47	22 51	22 56	23 02	23 08	23 15	23 24	23 34
	4	23 31	23 35	23 40	23 45	23 50	23 56	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
	5	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 02	0 09	0 17	0 26	0 36	0 48	1 03	1 20
	6	0 34	0 40	0 46	0 52	1 00	1 07	1 16	1 26	1 37	1 49	2 04	2 22	2 44	3 14
	7	1 36	1 43	1 50	1 58	2 07	2 16	2 27	2 39	2 53	3 10	3 30	3 55	4 31	5 40
	8	2 35	2 42	2 50	2 59	3 09	3 20	3 33	3 47	4 04	4 24	4 49	5 23	6 28	-- --
	9	3 29	3 37	3 46	3 55	4 06	4 17	4 30	4 45	5 03	5 25	5 52	6 32	-- --	-- --
	10	4 18	4 26	4 34	4 43	4 53	5 05	5 17	5 32	5 49	6 09	6 35	7 10	8 21	-- --
	11	5 00	5 08	5 15	5 24	5 33	5 43	5 54	6 07	6 21	6 39	6 59	7 26	8 03	9 28
	12	5 37	5 43	5 50	5 57	6 04	6 13	6 22	6 32	6 44	6 58	7 13	7 32	7 56	8 27
	13	6 09	6 13	6 19	6 24	6 30	6 36	6 44	6 51	7 00	7 10	7 22	7 35	7 50	8 09
	14	6 36	6 40	6 44	6 47	6 52	6 56	7 01	7 07	7 13	7 19	7 27	7 35	7 45	7 57
	15	7 02	7 04	7 06	7 08	7 11	7 13	7 16	7 19	7 23	7 26	7 31	7 35	7 41	7 47
	16	7 26	7 27	7 27	7 28	7 28	7 29	7 30	7 31	7 32	7 32	7 34	7 35	7 36	7 38

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	23	0 07	0 10	0 15	0 19	0 24	0 29	0 35	0 42	0 49	0 57	1 06	1 17	1 30	1 45
	24	1 18	1 24	1 29	1 36	1 43	1 50	1 59	2 08	2 19	2 31	2 46	3 03	3 24	3 52
	25	2 31	2 38	2 46	2 54	3 03	3 12	3 23	3 36	3 50	4 07	4 27	4 53	5 29	6 46
	26	3 43	3 51	3 59	4 09	4 19	4 30	4 43	4 57	5 14	5 35	6 01	6 37	7 52	** **
	27	4 49	4 57	5 06	5 15	5 26	5 37	5 50	6 05	6 22	6 43	7 09	7 46	9 09	** **
	28	5 46	5 53	6 01	6 10	6 19	6 29	6 41	6 54	7 09	7 26	7 47	8 14	8 53	** **
	29	6 33	6 39	6 45	6 52	7 00	7 08	7 17	7 27	7 38	7 51	8 06	8 25	8 47	9 16
	30	7 11	7 15	7 20	7 25	7 30	7 36	7 43	7 50	7 58	8 07	8 17	8 28	8 42	8 58
	31	7 43	7 45	7 48	7 52	7 55	7 59	8 02	8 07	8 12	8 17	8 23	8 30	8 37	8 46
Feb.	1	8 10	8 12	8 13	8 14	8 15	8 17	8 19	8 20	8 22	8 25	8 27	8 30	8 33	8 36
	2	8 36	8 35	8 35	8 35	8 34	8 34	8 33	8 32	8 32	8 31	8 30	8 29	8 28	8 27
	3	9 01	8 59	8 57	8 55	8 52	8 50	8 47	8 44	8 41	8 37	8 33	8 29	8 24	8 18
	4	9 26	9 23	9 19	9 16	9 11	9 07	9 02	8 57	8 51	8 45	8 37	8 29	8 19	8 08
	5	9 54	9 49	9 44	9 39	9 33	9 26	9 19	9 12	9 03	8 53	8 42	8 29	8 14	7 56
	6	10 25	10 19	10 12	10 06	9 58	9 50	9 41	9 30	9 19	9 06	8 50	8 32	8 09	7 38
	7	11 01	10 54	10 46	10 38	10 29	10 19	10 08	9 55	9 41	9 24	9 03	8 37	8 02	6 51
	8	11 42	11 35	11 26	11 17	11 07	10 56	10 43	10 29	10 12	9 52	9 27	8 52	7 47	-- --
	9	12 30	12 22	12 14	12 04	11 54	11 42	11 29	11 14	10 56	10 35	10 07	9 27	-- --	-- --
	10	13 25	13 17	13 09	13 00	12 50	12 39	12 26	12 12	11 55	11 35	11 09	10 34	9 24	-- --
	11	14 24	14 17	14 10	14 02	13 53	13 43	13 32	13 20	13 05	12 48	12 28	12 02	11 25	10 01
	12	15 26	15 20	15 14	15 08	15 00	14 52	14 44	14 34	14 22	14 10	13 54	13 36	13 13	12 42
	13	16 30	16 25	16 21	16 16	16 10	16 04	15 58	15 51	15 42	15 33	15 23	15 10	14 56	14 38
	14	17 34	17 31	17 28	17 25	17 21	17 17	17 13	17 08	17 03	16 57	16 51	16 43	16 35	16 24
	15	18 38	18 37	18 36	18 34	18 32	18 31	18 29	18 27	18 24	18 22	18 19	18 15	18 11	18 07
	16	19 43	19 44	19 44	19 44	19 44	19 45	19 45	19 45	19 46	19 46	19 47	19 47	19 48	19 49

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb. 15	5 47	5 55	6 02	6 07	6 12	6 16	6 23	6 29	6 35	6 40	6 47	6 53	6 57	7 02
16	7 07	7 09	7 11	7 12	7 13	7 14	7 16	7 18	7 19	7 20	7 22	7 24	7 25	7 26
17	8 28	8 24	8 21	8 18	8 15	8 13	8 10	8 07	8 04	8 01	7 58	7 54	7 52	7 50
18	9 51	9 41	9 32	9 25	9 19	9 14	9 05	8 57	8 50	8 43	8 35	8 26	8 22	8 16
19	11 17	11 00	10 46	10 35	10 25	10 17	10 03	9 50	9 39	9 27	9 15	9 01	8 53	8 45
20	12 46	12 21	12 02	11 46	11 33	11 22	11 03	10 46	10 31	10 16	10 00	9 41	9 30	9 18
21	14 13	13 41	13 17	12 58	12 43	12 29	12 06	11 46	11 27	11 09	10 49	10 27	10 14	9 58
22	15 32	14 56	14 29	14 08	13 50	13 35	13 10	12 48	12 27	12 07	11 45	11 20	11 05	10 48
23	16 35	15 59	15 32	15 11	14 53	14 38	14 12	13 50	13 29	13 09	12 46	12 21	12 05	11 48
24	17 19	16 47	16 24	16 04	15 48	15 34	15 11	14 50	14 31	14 12	13 51	13 27	13 13	12 57
25	17 48	17 24	17 05	16 49	16 36	16 24	16 04	15 47	15 30	15 14	14 56	14 36	14 24	14 10
26	18 09	17 51	17 37	17 26	17 16	17 07	16 52	16 39	16 26	16 14	16 00	15 45	15 36	15 26
27	18 23	18 13	18 04	17 57	17 50	17 45	17 35	17 26	17 18	17 10	17 02	16 52	16 46	16 39
28	18 36	18 31	18 27	18 24	18 21	18 19	18 15	18 11	18 07	18 04	18 00	17 56	17 53	17 51
Mar. 1	18 46	18 48	18 49	18 50	18 50	18 51	18 52	18 53	18 54	18 55	18 57	18 58	18 59	19 00
2	18 57	19 04	19 10	19 15	19 19	19 23	19 29	19 35	19 40	19 46	19 52	19 58	20 02	20 07
3	19 09	19 22	19 32	19 41	19 48	19 55	20 06	20 17	20 26	20 36	20 46	20 58	21 05	21 13
4	19 23	19 42	19 57	20 09	20 20	20 29	20 45	20 59	21 13	21 26	21 40	21 57	22 07	22 18
5	19 41	20 06	20 26	20 41	20 55	21 06	21 26	21 44	22 00	22 17	22 35	22 55	23 07	23 21
6	20 06	20 36	21 00	21 18	21 34	21 47	22 10	22 31	22 49	23 08	23 29	23 52	.. ..	.. ..
7	20 40	21 15	21 40	22 01	22 18	22 32	22 58	23 19	23 39	.. ..	.. ..	.. ..	0 06	0 22
8	21 26	22 02	22 29	22 50	23 07	23 22	23 47	.. ..	.. ..	0 00	0 21	0 47	1 02	1 19
9	22 25	22 59	23 24	23 44	.. ..	.. ..	.. ..	0 09	0 30	0 50	1 12	1 38	1 53	2 10
10	23 34	.. ..	.. ..	.. ..	0 01	0 15	0 39	1 00	1 20	1 40	2 01	2 25	2 39	2 55
11	.. ..	0 03	0 25	0 43	0 58	1 11	1 33	1 52	2 09	2 27	2 45	3 07	3 20	3 34

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb. 15	19 24	19 20	19 16	19 13	19 10	19 08	19 03	19 00	18 56	18 52	18 48	18 44	18 41	18 38
16	19 34	19 35	19 36	19 37	19 37	19 38	19 39	19 39	19 40	19 41	19 42	19 42	19 43	19 43
17	19 45	19 51	19 57	20 01	20 05	20 09	20 15	20 20	20 25	20 31	20 36	20 42	20 46	20 50
18	19 57	20 09	20 20	20 28	20 36	20 42	20 53	21 03	21 13	21 22	21 32	21 44	21 51	21 58
19	20 12	20 31	20 46	20 59	21 10	21 19	21 35	21 50	22 03	22 17	22 31	22 48	22 58	23 09
20	20 33	20 59	21 19	21 35	21 49	22 01	22 22	22 40	22 57	23 15	23 33	23 54	.. ..	.. ..
21	21 03	21 36	22 00	22 20	22 37	22 51	23 15	23 36	23 56	.. ..	.. ..	.. ..	0 06	0 21
22	21 50	22 27	22 53	23 15	23 32	23 48	.. ..	.. ..	.. ..	0 15	0 36	1 01	1 15	1 32
23	22 56	23 32	23 58	.. ..	.. ..	.. ..	0 14	0 36	0 57	1 17	1 40	2 05	2 21	2 38
24	.. ..	.. ..	.. ..	0 19	0 37	0 52	1 17	1 39	1 59	2 19	2 40	3 05	3 20	3 37
25	0 19	0 50	1 13	1 31	1 46	2 00	2 22	2 42	3 00	3 17	3 37	3 58	4 11	4 26
26	1 51	2 14	2 32	2 46	2 58	3 09	3 27	3 43	3 57	4 12	4 27	4 45	4 55	5 06
27	3 23	3 39	3 51	4 01	4 09	4 17	4 30	4 41	4 51	5 02	5 13	5 25	5 32	5 40
28	4 53	5 01	5 08	5 14	5 18	5 23	5 30	5 36	5 42	5 48	5 54	6 01	6 05	6 09
Mar. 1	6 19	6 21	6 23	6 24	6 25	6 26	6 27	6 29	6 30	6 31	6 32	6 34	6 35	6 35
2	7 43	7 39	7 35	7 32	7 29	7 27	7 23	7 20	7 16	7 13	7 10	7 06	7 03	7 01
3	9 05	8 54	8 46	8 39	8 33	8 27	8 18	8 10	8 02	7 55	7 47	7 37	7 32	7 26
4	10 26	10 09	9 55	9 44	9 35	9 26	9 12	9 00	8 48	8 37	8 25	8 11	8 03	7 53
5	11 45	11 22	11 03	10 49	10 36	10 25	10 07	9 50	9 35	9 20	9 04	8 46	8 36	8 24
6	13 01	12 31	12 09	11 51	11 36	11 23	11 01	10 42	10 24	10 06	9 47	9 25	9 12	8 58
7	14 09	13 35	13 10	12 50	12 33	12 19	11 54	11 33	11 13	10 54	10 33	10 08	9 54	9 37
8	15 07	14 32	14 05	13 44	13 27	13 12	12 46	12 24	12 04	11 43	11 21	10 56	10 41	10 23
9	15 52	15 18	14 53	14 32	14 15	14 01	13 36	13 14	12 54	12 34	12 12	11 47	11 32	11 15
10	16 25	15 55	15 33	15 14	14 59	14 45	14 23	14 03	13 44	13 25	13 05	12 42	12 28	12 12
11	16 49	16 25	16 06	15 50	15 37	15 26	15 06	14 49	14 32	14 16	13 58	13 38	13 26	13 12

(.. ..) indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb.	15	7 02	7 04	7 06	7 08	7 11	7 13	7 16	7 19	7 23	7 26	7 31	7 35	7 41	7 47
	16	7 26	7 27	7 27	7 28	7 28	7 29	7 30	7 31	7 32	7 32	7 34	7 35	7 36	7 38
	17	7 50	7 49	7 48	7 47	7 46	7 45	7 43	7 42	7 40	7 39	7 37	7 34	7 32	7 29
	18	8 16	8 13	8 11	8 08	8 05	8 02	7 58	7 54	7 50	7 46	7 40	7 34	7 27	7 20
	19	8 45	8 41	8 36	8 32	8 27	8 22	8 16	8 09	8 02	7 54	7 45	7 35	7 23	7 09
	20	9 18	9 13	9 07	9 00	8 54	8 46	8 38	8 29	8 19	8 07	7 54	7 38	7 19	6 55
	21	9 58	9 52	9 44	9 36	9 28	9 18	9 08	8 56	8 42	8 27	8 08	7 45	7 14	6 27
	22	10 48	10 40	10 32	10 23	10 13	10 02	9 50	9 36	9 19	9 00	8 35	8 03	7 08	** **
	23	11 48	11 40	11 31	11 22	11 12	11 00	10 47	10 32	10 15	9 54	9 27	8 50	** **	** **
	24	12 57	12 49	12 41	12 33	12 23	12 12	12 01	11 47	11 31	11 13	10 49	10 19	9 31	** **
	25	14 10	14 04	13 58	13 50	13 43	13 34	13 24	13 13	13 01	12 47	12 30	12 09	11 42	11 04
	26	15 26	15 21	15 16	15 11	15 05	14 59	14 52	14 44	14 35	14 25	14 14	14 01	13 45	13 25
	27	16 39	16 36	16 33	16 30	16 26	16 22	16 18	16 13	16 08	16 02	15 55	15 48	15 39	15 28
	28	17 51	17 49	17 48	17 47	17 45	17 43	17 42	17 40	17 37	17 35	17 32	17 29	17 26	17 21
Mar.	1	19 00	19 00	19 00	19 01	19 01	19 02	19 03	19 03	19 04	19 05	19 06	19 07	19 08	19 09
	2	20 07	20 09	20 11	20 13	20 16	20 18	20 21	20 25	20 28	20 32	20 37	20 42	20 48	20 55
	3	21 13	21 16	21 20	21 24	21 29	21 33	21 39	21 45	21 51	21 58	22 07	22 16	22 27	22 41
	4	22 18	22 23	22 28	22 34	22 40	22 47	22 55	23 03	23 13	23 24	23 36	23 51	.. ..	.. ..
	5	23 21	23 28	23 34	23 42	23 50	23 59	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 09	0 32
	6	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 08	0 19	0 32	0 47	1 04	1 26	1 54	2 36
	7	0 22	0 29	0 37	0 46	0 55	1 06	1 17	1 31	1 46	2 05	2 27	2 57	3 44	-- --
	8	1 19	1 27	1 35	1 45	1 55	2 06	2 19	2 34	2 51	3 12	3 38	4 16	-- --	-- --
	9	2 10	2 18	2 27	2 36	2 46	2 58	3 11	3 25	3 43	4 03	4 30	5 07	-- --	-- --
	10	2 55	3 03	3 11	3 19	3 29	3 39	3 51	4 05	4 20	4 39	5 01	5 31	6 15	-- --
	11	3 34	3 41	3 48	3 55	4 03	4 12	4 22	4 34	4 47	5 01	5 19	5 41	6 08	6 49

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb.	15	18 38	18 37	18 36	18 34	18 32	18 31	18 29	18 27	18 24	18 22	18 19	18 15	18 11	18 07
	16	19 43	19 44	19 44	19 44	19 44	19 45	19 45	19 45	19 46	19 46	19 47	19 47	19 48	19 49
	17	20 50	20 52	20 54	20 56	20 58	21 00	21 03	21 06	21 09	21 13	21 17	21 21	21 26	21 33
	18	21 58	22 02	22 05	22 09	22 13	22 18	22 23	22 29	22 35	22 42	22 50	22 59	23 10	23 23
	19	23 09	23 14	23 19	23 25	23 31	23 38	23 46	23 54	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
	20	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 04	0 15	0 27	0 42	1 00	1 23
	21	0 21	0 27	0 34	0 42	0 50	0 59	1 09	1 21	1 34	1 49	2 07	2 30	3 00	3 46
	22	1 32	1 39	1 47	1 56	2 06	2 17	2 29	2 43	2 59	3 18	3 42	4 15	5 09	** **
	23	2 38	2 46	2 55	3 04	3 15	3 26	3 39	3 54	4 11	4 32	4 59	5 37	** **	** **
	24	3 37	3 44	3 52	4 01	4 11	4 22	4 34	4 48	5 04	5 23	5 46	6 17	7 06	** **
	25	4 26	4 32	4 39	4 47	4 55	5 04	5 14	5 26	5 39	5 54	6 11	6 33	7 00	7 40
	26	5 06	5 11	5 17	5 23	5 29	5 36	5 44	5 52	6 01	6 12	6 24	6 39	6 56	7 17
	27	5 40	5 43	5 47	5 51	5 56	6 00	6 05	6 11	6 17	6 24	6 32	6 41	6 51	7 04
	28	6 09	6 11	6 13	6 15	6 18	6 20	6 23	6 26	6 29	6 33	6 37	6 42	6 47	6 53
Mar.	1	6 35	6 36	6 36	6 37	6 37	6 38	6 38	6 39	6 39	6 40	6 41	6 42	6 43	6 44
	2	7 01	7 00	6 58	6 57	6 56	6 54	6 53	6 51	6 49	6 47	6 44	6 42	6 39	6 35
	3	7 26	7 24	7 21	7 18	7 15	7 11	7 08	7 03	6 59	6 54	6 48	6 42	6 34	6 26
	4	7 53	7 49	7 45	7 40	7 35	7 30	7 24	7 18	7 10	7 02	6 53	6 42	6 30	6 15
	5	8 24	8 18	8 12	8 06	7 59	7 52	7 44	7 35	7 25	7 13	7 00	6 44	6 25	6 01
	6	8 58	8 51	8 44	8 36	8 28	8 19	8 09	7 57	7 44	7 29	7 11	6 49	6 20	5 37
	7	9 37	9 30	9 22	9 13	9 04	8 53	8 41	8 27	8 12	7 53	7 30	7 00	6 13	-- --
	8	10 23	10 15	10 07	9 57	9 47	9 36	9 23	9 08	8 51	8 30	8 03	7 25	-- --	-- --
	9	11 15	11 07	10 59	10 49	10 39	10 28	10 15	10 01	9 43	9 23	8 56	8 19	-- --	-- --
	10	12 12	12 05	11 57	11 48	11 39	11 29	11 17	11 04	10 49	10 31	10 09	9 39	8 55	-- --
	11	13 12	13 06	13 00	12 52	12 45	12 36	12 26	12 15	12 03	11 49	11 32	11 11	10 43	10 04

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar.	9	22 25	22 59	23 24	23 44	.. ..	.. ..	.. ..	0 09	0 30	0 50	1 12	1 38	1 53	2 10
	10	23 34	.. ..	.. ..	.. ..	0 01	0 15	0 39	1 00	1 20	1 40	2 01	2 25	2 39	2 55
	11	.. ..	0 03	0 25	0 43	0 58	1 11	1 33	1 52	2 09	2 27	2 45	3 07	3 20	3 34
	12	0 49	1 12	1 30	1 45	1 57	2 08	2 26	2 42	2 57	3 12	3 27	3 45	3 56	4 08
	13	2 07	2 24	2 37	2 48	2 58	3 06	3 20	3 32	3 43	3 54	4 06	4 20	4 28	4 37
	14	3 27	3 37	3 46	3 53	3 59	4 04	4 13	4 21	4 28	4 36	4 44	4 53	4 58	5 04
	15	4 47	4 51	4 55	4 58	5 00	5 03	5 06	5 10	5 13	5 16	5 20	5 24	5 26	5 29
	16	6 08	6 07	6 05	6 04	6 03	6 02	6 01	6 00	5 58	5 57	5 56	5 55	5 54	5 53
	17	7 32	7 24	7 18	7 12	7 08	7 04	6 57	6 51	6 45	6 39	6 34	6 27	6 23	6 19
	18	8 59	8 44	8 32	8 23	8 14	8 07	7 55	7 44	7 34	7 24	7 14	7 02	6 55	6 47
	19	10 28	10 06	9 49	9 35	9 23	9 13	8 56	8 41	8 26	8 12	7 58	7 41	7 31	7 20
	20	11 58	11 28	11 06	10 49	10 34	10 21	9 59	9 40	9 23	9 05	8 47	8 25	8 13	7 59
	21	13 21	12 46	12 20	12 00	11 43	11 28	11 03	10 42	10 22	10 02	9 41	9 17	9 02	8 46
	22	14 28	13 52	13 26	13 04	12 47	12 32	12 06	11 44	11 23	11 03	10 41	10 15	10 00	9 43
	23	15 18	14 45	14 20	14 00	13 44	13 30	13 05	12 44	12 25	12 05	11 44	11 19	11 05	10 48
	24	15 51	15 24	15 03	14 47	14 33	14 20	13 59	13 41	13 23	13 06	12 48	12 26	12 14	11 59
	25	16 13	15 53	15 38	15 25	15 14	15 04	14 47	14 33	14 19	14 05	13 50	13 33	13 23	13 12
	26	16 30	16 16	16 06	15 57	15 49	15 43	15 31	15 21	15 11	15 01	14 51	14 39	14 32	14 24
	27	16 43	16 36	16 30	16 25	16 21	16 17	16 11	16 05	16 00	15 54	15 49	15 42	15 38	15 34
	28	16 54	16 53	16 52	16 51	16 50	16 49	16 48	16 47	16 47	16 46	16 45	16 44	16 43	16 42
	29	17 05	17 09	17 13	17 16	17 19	17 21	17 25	17 29	17 32	17 36	17 40	17 44	17 46	17 49
	30	17 16	17 26	17 35	17 41	17 47	17 53	18 02	18 10	18 18	18 26	18 34	18 43	18 49	18 55
	31	17 30	17 46	17 58	18 09	18 18	18 26	18 40	18 53	19 04	19 16	19 28	19 43	19 51	20 01
Apr.	1	17 46	18 08	18 26	18 40	18 52	19 02	19 21	19 37	19 52	20 07	20 23	20 42	20 53	21 05
	2	18 09	18 36	18 58	19 15	19 29	19 42	20 04	20 23	20 41	20 58	21 18	21 40	21 53	22 08

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar.	9	15 52	15 18	14 53	14 32	14 15	14 01	13 36	13 14	12 54	12 34	12 12	11 47	11 32	11 15
	10	16 25	15 55	15 33	15 14	14 59	14 45	14 23	14 03	13 44	13 25	13 05	12 42	12 28	12 12
	11	16 49	16 25	16 06	15 50	15 37	15 26	15 06	14 49	14 32	14 16	13 58	13 38	13 26	13 12
	12	17 07	16 48	16 34	16 22	16 11	16 02	15 46	15 32	15 19	15 06	14 52	14 36	14 26	14 15
	13	17 21	17 08	16 58	16 49	16 42	16 36	16 24	16 14	16 05	15 55	15 45	15 34	15 27	15 19
	14	17 32	17 25	17 20	17 15	17 11	17 07	17 01	16 55	16 50	16 44	16 39	16 32	16 28	16 24
	15	17 43	17 41	17 40	17 39	17 39	17 38	17 37	17 36	17 35	17 34	17 32	17 31	17 30	17 29
	16	17 53	17 58	18 01	18 04	18 07	18 09	18 13	18 17	18 20	18 24	18 27	18 31	18 34	18 36
	17	18 05	18 16	18 24	18 31	18 37	18 43	18 52	19 00	19 08	19 16	19 24	19 34	19 39	19 46
	18	18 20	18 37	18 50	19 01	19 11	19 19	19 34	19 47	19 59	20 11	20 24	20 38	20 47	20 57
	19	18 39	19 03	19 21	19 37	19 49	20 01	20 20	20 37	20 53	21 09	21 26	21 45	21 57	22 10
	20	19 07	19 38	20 01	20 19	20 35	20 48	21 12	21 32	21 51	22 09	22 30	22 53	23 07	23 23
	21	19 49	20 24	20 50	21 11	21 29	21 43	22 09	22 31	22 51	23 12	23 33	23 59	.. ..	.. ..
	22	20 49	21 25	21 52	22 12	22 30	22 45	23 10	23 32	23 53	.. ..	.. ..	.. ..	0 14	0 31
	23	22 06	22 38	23 02	23 21	23 37	23 51	.. ..	.. ..	.. ..	0 13	0 35	1 00	1 15	1 32
	24	23 33	23 58	.. ..	.. ..	.. ..	.. ..	0 14	0 34	0 53	1 12	1 31	1 54	2 07	2 23
	25	.. ..	.. ..	0 18	0 34	0 47	0 58	1 18	1 35	1 50	2 06	2 23	2 41	2 52	3 05
	26	1 03	1 21	1 35	1 46	1 56	2 05	2 20	2 32	2 44	2 56	3 08	3 22	3 31	3 40
	27	2 31	2 42	2 50	2 58	3 04	3 09	3 19	3 27	3 34	3 42	3 50	3 59	4 04	4 10
	28	3 56	4 00	4 04	4 07	4 10	4 12	4 16	4 19	4 22	4 25	4 29	4 32	4 34	4 37
	29	5 19	5 17	5 16	5 15	5 14	5 13	5 11	5 10	5 08	5 07	5 06	5 04	5 03	5 02
	30	6 41	6 33	6 26	6 21	6 17	6 13	6 06	6 00	5 54	5 48	5 42	5 36	5 32	5 27
	31	8 02	7 47	7 36	7 27	7 19	7 12	7 00	6 50	6 40	6 30	6 20	6 08	6 01	5 54
Apr.	1	9 22	9 01	8 45	8 32	8 21	8 11	7 55	7 40	7 27	7 13	6 59	6 43	6 33	6 23
	2	10 39	10 13	9 52	9 36	9 22	9 10	8 49	8 32	8 15	7 59	7 41	7 21	7 09	6 55

(.. ..) indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 9	2 10	2 18	2 27	2 36	2 46	2 58	3 11	3 25	3 43	4 03	4 30	5 07	-- --	-- --
10	2 55	3 03	3 11	3 19	3 29	3 39	3 51	4 05	4 20	4 39	5 01	5 31	6 15	-- --
11	3 34	3 41	3 48	3 55	4 03	4 12	4 22	4 34	4 47	5 01	5 19	5 41	6 08	6 49
12	4 08	4 13	4 19	4 25	4 31	4 39	4 47	4 55	5 05	5 17	5 30	5 45	6 03	6 26
13	4 37	4 41	4 45	4 50	4 55	5 00	5 06	5 12	5 19	5 27	5 36	5 47	5 59	6 13
14	5 04	5 06	5 09	5 12	5 15	5 18	5 22	5 26	5 30	5 35	5 41	5 47	5 55	6 03
15	5 29	5 30	5 31	5 32	5 33	5 35	5 37	5 38	5 40	5 42	5 45	5 47	5 50	5 54
16	5 53	5 53	5 52	5 52	5 52	5 51	5 51	5 50	5 50	5 49	5 48	5 47	5 46	5 45
17	6 19	6 17	6 15	6 13	6 11	6 08	6 06	6 03	5 59	5 56	5 52	5 47	5 42	5 36
18	6 47	6 44	6 40	6 36	6 32	6 28	6 23	6 17	6 11	6 05	5 57	5 48	5 38	5 27
19	7 20	7 15	7 10	7 04	6 58	6 51	6 44	6 36	6 27	6 16	6 05	5 51	5 35	5 15
20	7 59	7 52	7 46	7 38	7 30	7 21	7 12	7 01	6 48	6 34	6 17	5 57	5 31	4 56
21	8 46	8 39	8 31	8 22	8 12	8 02	7 50	7 37	7 21	7 03	6 41	6 12	5 29	** **
22	9 43	9 35	9 26	9 17	9 07	8 56	8 43	8 28	8 11	7 51	7 25	6 49	5 36	** **
23	10 48	10 41	10 32	10 24	10 14	10 03	9 51	9 37	9 21	9 01	8 37	8 05	7 11	** **
24	11 59	11 52	11 45	11 38	11 29	11 20	11 10	10 58	10 45	10 29	10 11	9 48	9 17	8 27
25	13 12	13 07	13 01	12 55	12 49	12 42	12 34	12 25	12 15	12 04	11 51	11 36	11 17	10 53
26	14 24	14 20	14 17	14 13	14 08	14 03	13 58	13 52	13 46	13 39	13 30	13 21	13 10	12 56
27	15 34	15 32	15 30	15 28	15 26	15 23	15 20	15 17	15 14	15 10	15 06	15 01	14 56	14 49
28	16 42	16 42	16 42	16 42	16 41	16 41	16 40	16 40	16 39	16 39	16 38	16 37	16 37	16 36
29	17 49	17 51	17 52	17 53	17 55	17 57	17 59	18 01	18 03	18 06	18 08	18 12	18 15	18 20
30	18 55	18 58	19 01	19 05	19 08	19 12	19 16	19 21	19 26	19 31	19 38	19 45	19 54	20 04
31	20 01	20 05	20 10	20 15	20 20	20 26	20 33	20 40	20 48	20 57	21 08	21 20	21 34	21 52
Apr. 1	21 05	21 11	21 17	21 24	21 31	21 39	21 48	21 58	22 09	22 22	22 37	22 55	23 18	23 48
2	22 08	22 15	22 22	22 30	22 39	22 49	22 59	23 12	23 26	23 42	.. ..	.. ..	.. ..	.. ..

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 9	11 15	11 07	10 59	10 49	10 39	10 28	10 15	10 01	9 43	9 23	8 56	8 19	-- --	-- --
10	12 12	12 05	11 57	11 48	11 39	11 29	11 17	11 04	10 49	10 31	10 09	9 39	8 55	-- --
11	13 12	13 06	13 00	12 52	12 45	12 36	12 26	12 15	12 03	11 49	11 32	11 11	10 43	10 04
12	14 15	14 10	14 05	13 59	13 53	13 47	13 39	13 31	13 21	13 11	12 59	12 44	12 26	12 04
13	15 19	15 16	15 12	15 08	15 04	14 59	14 54	14 48	14 42	14 35	14 27	14 17	14 06	13 53
14	16 24	16 22	16 20	16 17	16 15	16 12	16 10	16 06	16 03	15 59	15 55	15 50	15 44	15 37
15	17 29	17 29	17 28	17 28	17 27	17 27	17 26	17 26	17 25	17 24	17 23	17 22	17 21	17 20
16	18 36	18 38	18 39	18 40	18 42	18 43	18 45	18 47	18 49	18 51	18 54	18 57	19 00	19 04
17	19 46	19 48	19 51	19 55	19 58	20 02	20 06	20 10	20 16	20 21	20 28	20 35	20 44	20 54
18	20 57	21 01	21 06	21 11	21 17	21 23	21 30	21 37	21 45	21 55	22 06	22 18	22 33	22 52
19	22 10	22 16	22 22	22 29	22 37	22 45	22 55	23 05	23 17	23 30	23 47	.. ..	.. ..	.. ..
20	23 23	23 30	23 38	23 46	23 55	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 06	0 31	1 05
21	.. ..	.. ..	.. ..	.. ..	.. ..	0 05	0 17	0 30	0 45	1 03	1 25	1 54	2 36	** **
22	0 31	0 39	0 47	0 56	1 07	1 18	1 31	1 45	2 02	2 23	2 49	3 24	4 37	** **
23	1 32	1 39	1 48	1 57	2 07	2 18	2 30	2 44	3 01	3 20	3 44	4 17	5 11	** **
24	2 23	2 30	2 37	2 45	2 54	3 03	3 14	3 26	3 40	3 56	4 15	4 39	5 11	6 01
25	3 05	3 10	3 16	3 23	3 30	3 38	3 46	3 55	4 06	4 18	4 31	4 48	5 08	5 33
26	3 40	3 44	3 48	3 53	3 58	4 04	4 10	4 16	4 23	4 32	4 41	4 52	5 04	5 19
27	4 10	4 12	4 15	4 18	4 21	4 24	4 28	4 32	4 37	4 41	4 47	4 53	5 00	5 09
28	4 37	4 38	4 39	4 40	4 41	4 43	4 44	4 46	4 47	4 49	4 51	4 54	4 57	5 00
29	5 02	5 01	5 01	5 00	5 00	4 59	4 59	4 58	4 57	4 56	4 55	4 54	4 53	4 51
30	5 27	5 25	5 23	5 21	5 19	5 16	5 13	5 10	5 07	5 03	4 59	4 54	4 49	4 43
31	5 54	5 50	5 47	5 43	5 39	5 34	5 29	5 24	5 18	5 11	5 04	4 55	4 45	4 33
Apr. 1	6 23	6 18	6 13	6 07	6 01	5 55	5 48	5 40	5 31	5 21	5 10	4 57	4 41	4 22
2	6 55	6 49	6 43	6 36	6 28	6 20	6 11	6 00	5 49	5 35	5 20	5 01	4 37	4 06

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	1	17 46	18 08	18 26	18 40	18 52	19 02	19 21	19 37	19 52	20 07	20 23	20 42	20 53	21 05
	2	18 09	18 36	18 58	19 15	19 29	19 42	20 04	20 23	20 41	20 58	21 18	21 40	21 53	22 08
	3	18 39	19 12	19 36	19 55	20 12	20 26	20 50	21 11	21 31	21 50	22 11	22 36	22 50	23 07
	4	19 20	19 56	20 21	20 42	20 59	21 14	21 39	22 01	22 21	22 42	23 03	23 29	23 44	.. ..
	5	20 14	20 49	21 14	21 34	21 51	22 06	22 30	22 52	23 12	23 32	23 53	.. ..	.. ..	0 01
	6	21 19	21 50	22 13	22 31	22 47	23 00	23 23	23 43	.. ..	.. ..	.. ..	0 17	0 32	0 49
	7	22 31	22 56	23 16	23 31	23 45	23 56	.. ..	.. ..	0 01	0 19	0 39	1 01	1 15	1 30
	8	23 47	.. ..	.. ..	.. ..	.. ..	.. ..	0 16	0 33	0 49	1 05	1 21	1 41	1 52	2 05
	9	.. ..	0 06	0 21	0 33	0 44	0 53	1 09	1 22	1 35	1 48	2 01	2 17	2 26	2 36
	10	1 04	1 17	1 28	1 36	1 44	1 50	2 01	2 11	2 20	2 29	2 39	2 50	2 56	3 03
	11	2 23	2 30	2 35	2 40	2 44	2 48	2 54	2 59	3 05	3 10	3 15	3 21	3 25	3 29
	12	3 43	3 44	3 45	3 45	3 46	3 47	3 48	3 48	3 49	3 50	3 51	3 52	3 53	3 53
	13	5 06	5 00	4 56	4 53	4 50	4 47	4 43	4 39	4 35	4 32	4 28	4 24	4 22	4 19
	14	6 32	6 20	6 11	6 03	5 56	5 51	5 41	5 32	5 24	5 16	5 08	4 58	4 53	4 46
	15	8 02	7 43	7 28	7 16	7 06	6 57	6 42	6 28	6 16	6 04	5 51	5 36	5 28	5 18
	16	9 34	9 08	8 48	8 32	8 18	8 06	7 46	7 28	7 12	6 56	6 39	6 20	6 08	5 55
	17	11 03	10 30	10 05	9 46	9 30	9 16	8 52	8 31	8 12	7 53	7 33	7 10	6 57	6 41
	18	12 18	11 42	11 16	10 55	10 38	10 23	9 57	9 35	9 15	8 55	8 33	8 08	7 53	7 36
	19	13 14	12 41	12 15	11 55	11 38	11 24	10 59	10 38	10 18	9 58	9 37	9 12	8 57	8 40
	20	13 52	13 24	13 03	12 45	12 30	12 18	11 56	11 36	11 19	11 01	10 41	10 19	10 06	9 51
	21	14 18	13 56	13 40	13 26	13 14	13 04	12 46	12 30	12 15	12 01	11 45	11 27	11 16	11 04
	22	14 36	14 21	14 09	13 59	13 51	13 43	13 30	13 19	13 08	12 57	12 45	12 32	12 24	12 16
	23	14 50	14 41	14 34	14 28	14 23	14 18	14 10	14 03	13 57	13 50	13 43	13 35	13 31	13 25
	24	15 02	14 59	14 56	14 54	14 52	14 51	14 48	14 46	14 43	14 41	14 39	14 36	14 34	14 33
	25	15 13	15 15	15 17	15 19	15 20	15 22	15 24	15 26	15 28	15 30	15 33	15 35	15 37	15 38

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	1	9 22	9 01	8 45	8 32	8 21	8 11	7 55	7 40	7 27	7 13	6 59	6 43	6 33	6 23
	2	10 39	10 13	9 52	9 36	9 22	9 10	8 49	8 32	8 15	7 59	7 41	7 21	7 09	6 55
	3	11 52	11 20	10 56	10 37	10 21	10 07	9 44	9 24	9 05	8 46	8 26	8 02	7 49	7 33
	4	12 55	12 20	11 54	11 34	11 17	11 02	10 37	10 15	9 55	9 35	9 13	8 48	8 34	8 17
	5	13 45	13 11	12 45	12 24	12 07	11 53	11 28	11 06	10 46	10 25	10 04	9 38	9 24	9 06
	6	14 23	13 51	13 28	13 09	12 53	12 39	12 15	11 55	11 36	11 16	10 56	10 32	10 18	10 01
	7	14 50	14 24	14 03	13 47	13 33	13 21	13 00	12 41	12 24	12 07	11 48	11 27	11 14	11 00
	8	15 10	14 49	14 33	14 20	14 08	13 58	13 41	13 26	13 11	12 57	12 41	12 23	12 13	12 01
	9	15 25	15 10	14 59	14 49	14 40	14 32	14 19	14 08	13 57	13 46	13 34	13 20	13 12	13 03
	10	15 38	15 29	15 21	15 15	15 09	15 04	14 56	14 48	14 41	14 34	14 27	14 18	14 13	14 07
	11	15 49	15 45	15 42	15 40	15 37	15 35	15 32	15 29	15 26	15 23	15 20	15 16	15 14	15 11
	12	16 00	16 02	16 03	16 05	16 06	16 07	16 08	16 10	16 11	16 12	16 14	16 15	16 16	16 17
	13	16 12	16 19	16 26	16 31	16 35	16 39	16 46	16 52	16 58	17 04	17 10	17 17	17 21	17 26
	14	16 25	16 39	16 51	17 00	17 08	17 15	17 27	17 38	17 48	17 59	18 09	18 22	18 29	18 38
	15	16 43	17 04	17 20	17 34	17 45	17 55	18 13	18 28	18 42	18 57	19 12	19 30	19 40	19 52
	16	17 09	17 37	17 58	18 15	18 30	18 42	19 04	19 23	19 40	19 58	20 17	20 39	20 52	21 07
	17	17 47	18 20	18 45	19 05	19 22	19 36	20 01	20 22	20 42	21 02	21 23	21 48	22 02	22 19
	18	18 42	19 18	19 44	20 05	20 22	20 37	21 03	21 25	21 45	22 06	22 27	22 52	23 07	23 24
	19	19 56	20 29	20 53	21 13	21 29	21 44	22 07	22 28	22 47	23 06	23 27	23 50	.. ..	.. ..
	20	21 21	21 48	22 09	22 25	22 39	22 51	23 12	23 30	23 46	.. ..	.. ..	.. ..	0 04	0 19
	21	22 50	23 10	23 25	23 38	23 49	23 58	.. ..	.. ..	.. ..	0 02	0 20	0 40	0 51	1 05
	22	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 14	0 28	0 41	0 54	1 07	1 23	1 31	1 42
	23	0 18	0 30	0 41	0 49	0 56	1 03	1 13	1 23	1 32	1 40	1 49	2 00	2 06	2 13
	24	1 42	1 48	1 53	1 58	2 01	2 05	2 10	2 15	2 19	2 24	2 28	2 34	2 37	2 40
	25	3 04	3 04	3 04	3 04	3 04	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05

(.. ..) indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 1	21 05	21 11	21 17	21 24	21 31	21 39	21 48	21 58	22 09	22 22	22 37	22 55	23 18	23 48
2	22 08	22 15	22 22	22 30	22 39	22 49	22 59	23 12	23 26	23 42	.. ..	.. ..	.. ..	.. ..
3	23 07	23 15	23 23	23 32	23 42	23 53	.. ..	.. ..	.. ..	.. ..	0 03	0 28	1 04	2 15
4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 05	0 19	0 35	0 55	1 19	1 53	2 52	-- --
5	0 01	0 09	0 17	0 27	0 37	0 48	1 01	1 15	1 33	1 53	2 19	2 56	4 22	-- --
6	0 49	0 56	1 04	1 13	1 23	1 34	1 46	2 00	2 16	2 35	2 59	3 30	4 21	-- --
7	1 30	1 36	1 44	1 52	2 00	2 10	2 21	2 33	2 46	3 03	3 22	3 46	4 18	5 10
8	2 05	2 11	2 17	2 24	2 31	2 39	2 47	2 57	3 08	3 21	3 35	3 53	4 14	4 42
9	2 36	2 40	2 45	2 50	2 56	3 02	3 09	3 16	3 24	3 33	3 44	3 56	4 10	4 28
10	3 03	3 06	3 10	3 13	3 17	3 21	3 26	3 31	3 36	3 43	3 50	3 58	4 07	4 17
11	3 29	3 30	3 32	3 34	3 36	3 39	3 41	3 44	3 47	3 50	3 54	3 58	4 03	4 09
12	3 53	3 54	3 54	3 54	3 55	3 55	3 56	3 56	3 57	3 57	3 58	3 59	3 59	4 00
13	4 19	4 18	4 16	4 15	4 14	4 12	4 10	4 09	4 07	4 04	4 02	3 59	3 56	3 52
14	4 46	4 44	4 41	4 38	4 34	4 31	4 27	4 23	4 18	4 13	4 07	4 00	3 53	3 44
15	5 18	5 14	5 09	5 04	4 59	4 53	4 47	4 40	4 32	4 24	4 14	4 03	3 49	3 34
16	5 55	5 50	5 43	5 37	5 29	5 22	5 13	5 03	4 52	4 40	4 25	4 08	3 47	3 20
17	6 41	6 34	6 26	6 18	6 09	5 59	5 48	5 36	5 22	5 05	4 45	4 20	3 46	2 48
18	7 36	7 28	7 20	7 11	7 01	6 50	6 38	6 23	6 07	5 47	5 23	4 50	3 54	** **
19	8 40	8 33	8 25	8 16	8 06	7 55	7 42	7 28	7 12	6 52	6 28	5 55	4 58	** **
20	9 51	9 44	9 37	9 29	9 20	9 10	9 00	8 47	8 33	8 17	7 57	7 32	6 57	5 53
21	11 04	10 58	10 52	10 46	10 39	10 31	10 23	10 14	10 03	9 51	9 36	9 19	8 58	8 30
22	12 16	12 12	12 07	12 03	11 58	11 53	11 47	11 40	11 33	11 25	11 15	11 04	10 51	10 36
23	13 25	13 23	13 20	13 18	13 15	13 12	13 08	13 04	13 00	12 55	12 50	12 44	12 37	12 29
24	14 33	14 32	14 31	14 30	14 29	14 28	14 27	14 26	14 24	14 23	14 21	14 19	14 17	14 14
25	15 38	15 39	15 40	15 41	15 42	15 43	15 44	15 45	15 47	15 48	15 50	15 52	15 54	15 56

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 1	6 23	6 18	6 13	6 07	6 01	5 55	5 48	5 40	5 31	5 21	5 10	4 57	4 41	4 22
2	6 55	6 49	6 43	6 36	6 28	6 20	6 11	6 00	5 49	5 35	5 20	5 01	4 37	4 06
3	7 33	7 26	7 19	7 10	7 01	6 51	6 40	6 28	6 13	5 56	5 36	5 10	4 34	3 22
4	8 17	8 09	8 01	7 52	7 42	7 31	7 18	7 04	6 48	6 28	6 03	5 29	4 30	-- --
5	9 06	8 59	8 50	8 41	8 31	8 19	8 07	7 52	7 35	7 14	6 48	6 12	4 45	-- --
6	10 01	9 54	9 46	9 37	9 27	9 17	9 05	8 51	8 35	8 16	7 53	7 22	6 31	-- --
7	11 00	10 53	10 46	10 39	10 30	10 21	10 11	9 59	9 46	9 30	9 11	8 48	8 16	7 25
8	12 01	11 56	11 50	11 44	11 37	11 29	11 21	11 12	11 01	10 49	10 35	10 19	9 58	9 31
9	13 03	12 59	12 55	12 50	12 45	12 40	12 34	12 27	12 19	12 11	12 01	11 50	11 37	11 20
10	14 07	14 04	14 01	13 58	13 55	13 52	13 48	13 44	13 39	13 34	13 28	13 21	13 13	13 04
11	15 11	15 10	15 09	15 08	15 06	15 05	15 03	15 02	15 00	14 57	14 55	14 52	14 49	14 45
12	16 17	16 18	16 18	16 19	16 19	16 20	16 21	16 21	16 22	16 23	16 24	16 25	16 27	16 28
13	17 26	17 28	17 30	17 33	17 35	17 38	17 41	17 44	17 48	17 52	17 57	18 02	18 08	18 15
14	18 38	18 41	18 45	18 50	18 54	18 59	19 05	19 11	19 18	19 25	19 34	19 44	19 56	20 11
15	19 52	19 57	20 03	20 09	20 16	20 23	20 31	20 40	20 51	21 03	21 16	21 33	21 53	22 19
16	21 07	21 14	21 21	21 29	21 37	21 47	21 58	22 10	22 23	22 39	22 59	23 23	23 57	.. ..
17	22 19	22 27	22 35	22 44	22 54	23 05	23 17	23 31	23 47	.. ..	.. ..	.. ..	.. ..	0 54
18	23 24	23 32	23 40	23 49	23 59	.. ..	.. ..	.. ..	.. ..	0 07	0 31	1 04	1 59	** **
19	.. ..	.. ..	.. ..	.. ..	.. ..	0 11	0 23	0 37	0 54	1 14	1 38	2 12	3 09	** **
20	0 19	0 27	0 34	0 42	0 51	1 01	1 13	1 25	1 40	1 56	2 17	2 42	3 18	4 22
21	1 05	1 11	1 17	1 24	1 31	1 39	1 48	1 58	2 09	2 22	2 37	2 55	3 17	3 46
22	1 42	1 46	1 51	1 56	2 01	2 07	2 14	2 21	2 29	2 39	2 49	3 01	3 15	3 32
23	2 13	2 16	2 19	2 22	2 26	2 30	2 34	2 39	2 44	2 50	2 56	3 03	3 12	3 22
24	2 40	2 41	2 43	2 45	2 46	2 48	2 50	2 53	2 55	2 58	3 01	3 05	3 09	3 13
25	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	24	15 02	14 59	14 56	14 54	14 52	14 51	14 48	14 46	14 43	14 41	14 39	14 36	14 34	14 33
	25	15 13	15 15	15 17	15 19	15 20	15 22	15 24	15 26	15 28	15 30	15 33	15 35	15 37	15 38
	26	15 24	15 32	15 38	15 44	15 49	15 53	16 00	16 07	16 13	16 19	16 26	16 34	16 38	16 43
	27	15 36	15 50	16 01	16 10	16 18	16 25	16 38	16 48	16 59	17 09	17 20	17 32	17 40	17 48
	28	15 52	16 12	16 27	16 40	16 51	17 00	17 17	17 31	17 45	17 59	18 14	18 31	18 41	18 52
	29	16 12	16 37	16 57	17 13	17 27	17 39	17 59	18 17	18 33	18 50	19 08	19 29	19 41	19 56
	30	16 39	17 10	17 33	17 52	18 07	18 21	18 44	19 04	19 23	19 42	20 02	20 26	20 40	20 56
May	1	17 17	17 51	18 16	18 36	18 53	19 08	19 32	19 54	20 14	20 34	20 55	21 20	21 35	21 52
	2	18 06	18 41	19 06	19 27	19 44	19 58	20 23	20 44	21 04	21 24	21 46	22 11	22 25	22 42
	3	19 07	19 39	20 03	20 22	20 38	20 52	21 15	21 35	21 54	22 13	22 33	22 56	23 10	23 25
	4	20 16	20 43	21 04	21 21	21 35	21 47	22 07	22 25	22 42	22 59	23 17	23 37	23 49	.. ..
	5	21 30	21 51	22 07	22 21	22 32	22 43	23 00	23 15	23 28	23 42	23 57	.. ..	.. ..	0 03
	6	22 45	23 00	23 12	23 22	23 31	23 38	23 51	.. ..	.. ..	.. ..	.. ..	0 14	0 24	0 35
	7	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 03	0 13	0 24	0 35	0 47	0 55	1 03
	8	0 01	0 11	0 18	0 25	0 30	0 35	0 43	0 50	0 57	1 03	1 11	1 19	1 23	1 29
	9	1 19	1 22	1 25	1 28	1 30	1 32	1 35	1 38	1 40	1 43	1 46	1 49	1 51	1 53
	10	2 38	2 36	2 34	2 33	2 31	2 30	2 28	2 27	2 25	2 23	2 22	2 20	2 19	2 18
	11	4 02	3 53	3 46	3 40	3 36	3 31	3 24	3 18	3 12	3 06	2 59	2 52	2 48	2 44
	12	5 29	5 14	5 02	4 52	4 43	4 36	4 23	4 12	4 02	3 51	3 41	3 28	3 21	3 13
	13	7 01	6 39	6 21	6 07	5 55	5 44	5 26	5 11	4 56	4 42	4 27	4 09	3 59	3 48
	14	8 34	8 04	7 41	7 23	7 08	6 55	6 33	6 13	5 56	5 38	5 19	4 57	4 45	4 30
	15	9 58	9 23	8 57	8 37	8 20	8 05	7 40	7 19	6 59	6 39	6 18	5 54	5 39	5 23
	16	11 04	10 29	10 04	9 43	9 26	9 11	8 46	8 24	8 04	7 44	7 22	6 57	6 43	6 26
	17	11 50	11 20	10 57	10 39	10 23	10 10	9 47	9 27	9 08	8 49	8 29	8 06	7 52	7 37
	18	12 21	11 57	11 39	11 24	11 11	11 00	10 41	10 24	10 08	9 52	9 35	9 16	9 04	8 51

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	24	1 42	1 48	1 53	1 58	2 01	2 05	2 10	2 15	2 19	2 24	2 28	2 34	2 37	2 40
	25	3 04	3 04	3 04	3 04	3 04	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05
	26	4 24	4 18	4 14	4 10	4 06	4 03	3 58	3 54	3 50	3 46	3 41	3 36	3 33	3 30
	27	5 44	5 32	5 22	5 15	5 08	5 02	4 52	4 43	4 35	4 27	4 18	4 08	4 02	3 56
	28	7 03	6 45	6 31	6 19	6 09	6 01	5 46	5 33	5 21	5 09	4 56	4 41	4 33	4 23
	29	8 21	7 57	7 38	7 23	7 10	6 59	6 40	6 24	6 08	5 53	5 37	5 18	5 07	4 55
	30	9 35	9 05	8 43	8 25	8 10	7 57	7 34	7 15	6 57	6 39	6 20	5 58	5 45	5 30
May	1	10 42	10 08	9 43	9 23	9 07	8 53	8 28	8 07	7 48	7 28	7 07	6 43	6 28	6 12
	2	11 37	11 03	10 37	10 17	10 00	9 45	9 20	8 58	8 38	8 18	7 57	7 31	7 17	7 00
	3	12 20	11 47	11 23	11 03	10 47	10 33	10 09	9 48	9 29	9 09	8 48	8 24	8 09	7 53
	4	12 50	12 22	12 01	11 44	11 29	11 16	10 54	10 35	10 17	10 00	9 40	9 18	9 05	8 50
	5	13 13	12 50	12 33	12 18	12 06	11 55	11 36	11 20	11 05	10 49	10 33	10 14	10 02	9 49
	6	13 30	13 13	12 59	12 48	12 38	12 30	12 15	12 02	11 50	11 38	11 25	11 09	11 01	10 51
	7	13 43	13 32	13 23	13 15	13 08	13 02	12 52	12 43	12 34	12 25	12 16	12 06	11 59	11 52
	8	13 55	13 49	13 44	13 40	13 36	13 33	13 27	13 22	13 18	13 13	13 08	13 02	12 59	12 55
	9	14 06	14 05	14 04	14 04	14 04	14 03	14 03	14 02	14 01	14 01	14 00	13 59	13 59	13 59
	10	14 17	14 22	14 26	14 29	14 32	14 35	14 39	14 43	14 47	14 51	14 55	14 59	15 02	15 05
	11	14 29	14 40	14 49	14 56	15 03	15 08	15 18	15 27	15 35	15 43	15 52	16 02	16 07	16 14
	12	14 45	15 03	15 17	15 28	15 38	15 47	16 02	16 15	16 27	16 39	16 53	17 08	17 17	17 27
	13	15 07	15 32	15 51	16 06	16 19	16 31	16 50	17 08	17 24	17 40	17 57	18 17	18 29	18 43
	14	15 40	16 11	16 34	16 53	17 09	17 23	17 46	18 06	18 25	18 44	19 05	19 28	19 42	19 58
	15	16 29	17 04	17 30	17 51	18 08	18 23	18 48	19 10	19 30	19 50	20 12	20 37	20 52	21 09
	16	17 38	18 12	18 38	18 58	19 15	19 29	19 54	20 15	20 35	20 55	21 16	21 40	21 54	22 10
	17	19 03	19 32	19 54	20 12	20 26	20 39	21 01	21 20	21 37	21 55	22 13	22 34	22 46	23 01
	18	20 34	20 56	21 13	21 27	21 38	21 49	22 06	22 21	22 35	22 49	23 04	23 21	23 30	23 41

(.. ..) indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	24	14 33	14 32	14 31	14 30	14 29	14 28	14 27	14 26	14 24	14 23	14 21	14 19	14 17	14 14
	25	15 38	15 39	15 40	15 41	15 42	15 43	15 44	15 45	15 47	15 48	15 50	15 52	15 54	15 56
	26	16 43	16 46	16 48	16 51	16 54	16 57	17 00	17 04	17 08	17 12	17 17	17 23	17 30	17 38
	27	17 48	17 52	17 56	18 00	18 05	18 10	18 16	18 22	18 29	18 36	18 45	18 56	19 08	19 22
	28	18 52	18 58	19 03	19 09	19 15	19 23	19 30	19 39	19 49	20 00	20 14	20 29	20 48	21 12
	29	19 56	20 02	20 09	20 16	20 24	20 33	20 43	20 54	21 07	21 22	21 40	22 02	22 31	23 16
	30	20 56	21 03	21 11	21 20	21 29	21 39	21 51	22 04	22 20	22 38	23 01	23 30	.. ..	-- --
May	1	21 52	22 00	22 08	22 17	22 27	22 38	22 51	23 05	23 22	23 42	.. ..	.. ..	0 16	-- --
	2	22 42	22 50	22 58	23 07	23 17	23 28	23 40	23 54	.. ..	.. ..	0 08	0 42	1 50	-- --
	3	23 25	23 32	23 40	23 48	23 57	.. ..	.. ..	.. ..	0 10	0 30	0 54	1 27	2 23	-- --
	4	.. ..	.. ..	.. ..	.. ..	.. ..	0 07	0 18	0 31	0 46	1 03	1 23	1 49	2 25	3 39
	5	0 03	0 09	0 15	0 22	0 30	0 39	0 48	0 58	1 10	1 24	1 40	1 59	2 23	2 56
	6	0 35	0 40	0 45	0 51	0 57	1 03	1 11	1 19	1 28	1 39	1 50	2 04	2 21	2 41
	7	1 03	1 06	1 10	1 15	1 19	1 24	1 29	1 35	1 42	1 49	1 57	2 07	2 18	2 30
	8	1 29	1 31	1 33	1 36	1 39	1 42	1 45	1 49	1 53	1 57	2 02	2 08	2 14	2 22
	9	1 53	1 54	1 55	1 56	1 57	1 58	2 00	2 01	2 03	2 04	2 06	2 09	2 11	2 14
	10	2 18	2 17	2 17	2 16	2 15	2 15	2 14	2 13	2 12	2 11	2 10	2 09	2 08	2 06
	11	2 44	2 42	2 40	2 38	2 35	2 32	2 30	2 27	2 23	2 19	2 15	2 10	2 05	1 59
	12	3 13	3 10	3 06	3 02	2 58	2 53	2 48	2 42	2 36	2 29	2 21	2 12	2 02	1 50
	13	3 48	3 43	3 38	3 32	3 25	3 19	3 11	3 03	2 53	2 43	2 31	2 17	2 00	1 39
	14	4 30	4 24	4 17	4 10	4 01	3 52	3 42	3 31	3 19	3 04	2 47	2 26	1 59	1 22
	15	5 23	5 15	5 07	4 59	4 49	4 38	4 27	4 13	3 58	3 39	3 17	2 47	2 04	** **
	16	6 26	6 18	6 10	6 00	5 50	5 39	5 27	5 13	4 56	4 36	4 12	3 38	2 40	** **
	17	7 37	7 29	7 22	7 13	7 04	6 54	6 43	6 30	6 15	5 57	5 36	5 08	4 27	** **
	18	8 51	8 45	8 39	8 32	8 25	8 16	8 07	7 57	7 45	7 32	7 16	6 56	6 32	5 58

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	24	2 40	2 41	2 43	2 45	2 46	2 48	2 50	2 53	2 55	2 58	3 01	3 05	3 09	3 13
	25	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05	3 05
	26	3 30	3 29	3 27	3 25	3 24	3 22	3 20	3 18	3 15	3 12	3 09	3 06	3 02	2 57
	27	3 56	3 53	3 50	3 47	3 43	3 39	3 35	3 31	3 26	3 20	3 14	3 07	2 59	2 49
	28	4 23	4 19	4 15	4 10	4 05	3 59	3 53	3 46	3 38	3 30	3 20	3 08	2 55	2 40
	29	4 55	4 49	4 43	4 37	4 30	4 22	4 14	4 05	3 54	3 42	3 28	3 12	2 52	2 27
	30	5 30	5 24	5 17	5 09	5 01	4 51	4 41	4 29	4 16	4 01	3 42	3 20	2 50	2 05
May	1	6 12	6 05	5 57	5 48	5 38	5 28	5 16	5 02	4 47	4 28	4 05	3 35	2 49	-- --
	2	7 00	6 52	6 43	6 34	6 24	6 13	6 01	5 46	5 29	5 09	4 44	4 09	3 01	-- --
	3	7 53	7 45	7 37	7 28	7 18	7 07	6 55	6 41	6 25	6 06	5 42	5 09	4 13	-- --
	4	8 50	8 43	8 36	8 28	8 19	8 09	7 58	7 46	7 32	7 15	6 55	6 29	5 53	4 41
	5	9 49	9 44	9 37	9 31	9 23	9 15	9 06	8 56	8 45	8 32	8 16	7 58	7 34	7 02
	6	10 51	10 46	10 41	10 36	10 30	10 24	10 17	10 10	10 01	9 51	9 40	9 27	9 12	8 52
	7	11 52	11 49	11 46	11 42	11 38	11 34	11 29	11 24	11 18	11 12	11 05	10 56	10 46	10 35
	8	12 55	12 53	12 51	12 49	12 47	12 45	12 42	12 39	12 36	12 33	12 29	12 25	12 20	12 14
	9	13 59	13 58	13 58	13 58	13 58	13 57	13 57	13 57	13 56	13 56	13 55	13 55	13 54	13 53
	10	15 05	15 06	15 07	15 09	15 11	15 12	15 14	15 16	15 19	15 21	15 24	15 28	15 31	15 36
	11	16 14	16 17	16 20	16 23	16 27	16 31	16 35	16 40	16 45	16 51	16 58	17 06	17 15	17 25
	12	17 27	17 32	17 36	17 42	17 47	17 54	18 01	18 08	18 17	18 26	18 38	18 51	19 07	19 26
	13	18 43	18 49	18 55	19 02	19 10	19 19	19 28	19 39	19 51	20 05	20 22	20 42	21 08	21 44
	14	19 58	20 06	20 13	20 22	20 31	20 42	20 53	21 06	21 22	21 40	22 02	22 31	23 14	** **
	15	21 09	21 17	21 25	21 34	21 44	21 55	22 08	22 22	22 38	22 58	23 23	23 57	.. ..	** **
	16	22 10	22 17	22 25	22 34	22 43	22 54	23 05	23 19	23 34	23 52	.. ..	.. ..	0 55	** **
	17	23 01	23 07	23 14	23 21	23 29	23 38	23 47	23 58	.. ..	.. ..	0 14	0 42	1 23	** **
	18	23 41	23 46	23 51	23 57	.. ..	.. ..	.. ..	.. ..	0 10	0 24	0 41	1 01	1 26	2 01

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
May	17	11 50	11 20	10 57	10 39	10 23	10 10	9 47	9 27	9 08	8 49	8 29	8 06	7 52	7 37
	18	12 21	11 57	11 39	11 24	11 11	11 00	10 41	10 24	10 08	9 52	9 35	9 16	9 04	8 51
	19	12 42	12 25	12 12	12 00	11 51	11 43	11 28	11 15	11 04	10 52	10 39	10 24	10 15	10 06
	20	12 57	12 47	12 38	12 31	12 25	12 20	12 10	12 02	11 54	11 47	11 38	11 29	11 23	11 17
	21	13 09	13 05	13 01	12 58	12 55	12 53	12 49	12 45	12 42	12 39	12 35	12 31	12 28	12 26
	22	13 21	13 22	13 22	13 23	13 24	13 24	13 25	13 26	13 27	13 28	13 29	13 30	13 31	13 32
	23	13 32	13 38	13 44	13 48	13 52	13 55	14 01	14 07	14 12	14 17	14 22	14 29	14 32	14 36
	24	13 44	13 56	14 06	14 14	14 21	14 27	14 38	14 47	14 56	15 05	15 15	15 26	15 33	15 40
	25	13 58	14 16	14 30	14 42	14 52	15 01	15 16	15 29	15 42	15 55	16 08	16 24	16 33	16 44
	26	14 17	14 40	14 58	15 13	15 26	15 37	15 57	16 13	16 29	16 45	17 02	17 22	17 33	17 47
	27	14 41	15 10	15 32	15 50	16 05	16 18	16 40	17 00	17 18	17 36	17 56	18 19	18 32	18 48
	28	15 15	15 48	16 13	16 32	16 49	17 03	17 27	17 49	18 08	18 28	18 49	19 14	19 28	19 45
	29	16 01	16 35	17 01	17 21	17 38	17 52	18 17	18 39	18 59	19 19	19 40	20 05	20 20	20 37
	30	16 58	17 31	17 55	18 15	18 31	18 45	19 09	19 30	19 49	20 08	20 29	20 52	21 06	21 23
	31	18 05	18 33	18 55	19 12	19 27	19 40	20 01	20 20	20 38	20 55	21 14	21 35	21 47	22 02
June	1	19 17	19 40	19 58	20 12	20 24	20 35	20 53	21 09	21 24	21 39	21 55	22 13	22 23	22 35
	2	20 31	20 48	21 02	21 13	21 22	21 31	21 45	21 57	22 09	22 21	22 33	22 47	22 55	23 04
	3	21 45	21 57	22 06	22 14	22 20	22 26	22 36	22 44	22 52	23 00	23 09	23 18	23 24	23 30
	4	23 01	23 06	23 11	23 15	23 18	23 21	23 26	23 31	23 35	23 39	23 43	23 49	23 51	23 55
	5	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
	6	0 17	0 17	0 17	0 17	0 17	0 17	0 18	0 18	0 18	0 18	0 18	0 18	0 18	0 18
	7	1 36	1 31	1 26	1 22	1 19	1 16	1 11	1 06	1 02	0 58	0 54	0 49	0 46	0 43
	8	3 00	2 47	2 38	2 30	2 23	2 17	2 06	1 58	1 49	1 41	1 32	1 22	1 17	1 10
	9	4 28	4 08	3 53	3 41	3 31	3 22	3 06	2 53	2 40	2 28	2 15	2 00	1 51	1 41
	10	5 59	5 32	5 12	4 56	4 42	4 30	4 10	3 53	3 36	3 20	3 03	2 43	2 32	2 19

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
May	17	19 03	19 32	19 54	20 12	20 26	20 39	21 01	21 20	21 37	21 55	22 13	22 34	22 46	23 01
	18	20 34	20 56	21 13	21 27	21 38	21 49	22 06	22 21	22 35	22 49	23 04	23 21	23 30	23 41
	19	22 04	22 19	22 30	22 40	22 48	22 55	23 08	23 18	23 28	23 38	23 49	.. ..	.. ..	.. ..
	20	23 30	23 38	23 45	23 50	23 55	23 59	.. ..	.. ..	.. ..	.. ..	.. ..	0 00	0 07	0 15
	21	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 06	0 12	0 17	0 23	0 29	0 35	0 39	0 43
	22	0 53	0 55	0 56	0 58	0 59	0 59	1 01	1 02	1 04	1 05	1 06	1 08	1 09	1 09
	23	2 13	2 09	2 06	2 03	2 00	1 58	1 55	1 52	1 49	1 46	1 42	1 39	1 37	1 34
	24	3 32	3 22	3 14	3 07	3 01	2 56	2 48	2 40	2 33	2 26	2 18	2 10	2 05	1 59
	25	4 50	4 34	4 21	4 11	4 02	3 54	3 41	3 29	3 18	3 07	2 56	2 42	2 35	2 26
	26	6 08	5 45	5 28	5 14	5 02	4 52	4 34	4 19	4 04	3 50	3 35	3 17	3 07	2 56
	27	7 23	6 55	6 33	6 16	6 02	5 49	5 28	5 10	4 53	4 35	4 17	3 56	3 44	3 30
	28	8 32	7 59	7 35	7 16	6 59	6 46	6 22	6 01	5 42	5 23	5 03	4 39	4 25	4 09
	29	9 31	8 56	8 31	8 11	7 54	7 39	7 14	6 53	6 33	6 13	5 51	5 26	5 12	4 55
	30	10 17	9 44	9 19	8 59	8 43	8 29	8 04	7 43	7 23	7 03	6 42	6 17	6 03	5 46
	31	10 52	10 22	10 00	9 42	9 27	9 13	8 51	8 31	8 13	7 54	7 34	7 11	6 58	6 42
June	1	11 17	10 52	10 33	10 18	10 05	9 53	9 34	9 16	9 00	8 44	8 27	8 06	7 55	7 41
	2	11 35	11 16	11 01	10 49	10 39	10 29	10 13	9 59	9 46	9 33	9 18	9 02	8 52	8 41
	3	11 49	11 36	11 25	11 17	11 09	11 02	10 50	10 40	10 30	10 20	10 09	9 57	9 50	9 42
	4	12 01	11 53	11 47	11 42	11 37	11 33	11 25	11 19	11 13	11 07	11 00	10 52	10 48	10 43
	5	12 12	12 09	12 07	12 05	12 04	12 02	12 00	11 57	11 55	11 53	11 51	11 48	11 47	11 45
	6	12 23	12 25	12 27	12 29	12 31	12 32	12 35	12 37	12 39	12 41	12 43	12 45	12 46	12 48
	7	12 34	12 42	12 49	12 55	13 00	13 04	13 11	13 18	13 24	13 30	13 37	13 44	13 49	13 54
	8	12 48	13 02	13 14	13 23	13 32	13 39	13 51	14 02	14 13	14 23	14 34	14 47	14 55	15 03
	9	13 07	13 27	13 44	13 57	14 09	14 19	14 37	14 52	15 06	15 21	15 36	15 54	16 04	16 16
	10	13 33	14 01	14 22	14 39	14 54	15 07	15 28	15 47	16 05	16 23	16 42	17 04	17 17	17 32

(.. ..) indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
May	17	7 37	7 29	7 22	7 13	7 04	6 54	6 43	6 30	6 15	5 57	5 36	5 08	4 27	** **
	18	8 51	8 45	8 39	8 32	8 25	8 16	8 07	7 57	7 45	7 32	7 16	6 56	6 32	5 58
	19	10 06	10 01	9 56	9 51	9 46	9 40	9 33	9 26	9 18	9 08	8 58	8 45	8 30	8 12
	20	11 17	11 14	11 11	11 08	11 05	11 01	10 57	10 52	10 47	10 42	10 35	10 28	10 19	10 09
	21	12 26	12 24	12 23	12 22	12 20	12 19	12 17	12 15	12 13	12 11	12 08	12 05	12 01	11 57
	22	13 32	13 32	13 32	13 33	13 33	13 34	13 34	13 35	13 35	13 36	13 37	13 38	13 39	13 40
	23	14 36	14 38	14 40	14 42	14 45	14 47	14 50	14 53	14 56	15 00	15 04	15 09	15 14	15 20
	24	15 40	15 44	15 47	15 51	15 55	15 59	16 04	16 10	16 16	16 23	16 30	16 39	16 50	17 02
	25	16 44	16 48	16 54	16 59	17 05	17 11	17 19	17 26	17 35	17 46	17 57	18 11	18 28	18 48
	26	17 47	17 53	17 59	18 06	18 14	18 22	18 31	18 42	18 54	19 07	19 24	19 43	20 08	20 44
	27	18 48	18 55	19 02	19 10	19 19	19 29	19 40	19 53	20 08	20 25	20 46	21 13	21 51	-- --
	28	19 45	19 53	20 01	20 10	20 20	20 30	20 43	20 57	21 13	21 33	21 57	22 31	23 29	-- --
	29	20 37	20 45	20 53	21 02	21 12	21 23	21 35	21 50	22 06	22 26	22 51	23 25	.. ..	-- --
	30	21 23	21 30	21 38	21 46	21 55	22 06	22 17	22 30	22 45	23 03	23 25	23 53	0 25	-- --
	31	22 02	22 08	22 15	22 22	22 31	22 40	22 49	23 01	23 13	23 28	23 45	.. ..	0 34	-- --
June	1	22 35	22 40	22 46	22 52	22 59	23 06	23 14	23 23	23 33	23 45	23 58	0 07	0 34	1 12
	2	23 04	23 08	23 13	23 17	23 22	23 28	23 34	23 41	23 48	23 56	.. ..	0 13	0 32	0 55
	3	23 30	23 33	23 36	23 39	23 43	23 46	23 50	23 55	.. ..	.. ..	0 06	0 16	0 29	0 44
	4	23 55	23 56	23 58	23 59	.. ..	.. ..	.. ..	.. ..	0 00	0 05	0 11	0 18	0 26	0 35
	5	.. ..	.. ..	.. ..	.. ..	0 01	0 03	0 05	0 07	0 10	0 12	0 15	0 19	0 23	0 27
	6	0 18	0 19	0 19	0 19	0 19	0 19	0 19	0 19	0 19	0 19	0 19	0 19	0 20	0 20
	7	0 43	0 42	0 40	0 39	0 37	0 35	0 33	0 31	0 29	0 26	0 23	0 20	0 17	0 12
	8	1 10	1 07	1 04	1 01	0 58	0 54	0 50	0 45	0 40	0 35	0 29	0 22	0 14	0 04
	9	1 41	1 37	1 32	1 27	1 22	1 16	1 10	1 03	0 55	0 46	0 36	0 25	0 11	23 43
	10	2 19	2 13	2 07	2 00	1 53	1 45	1 36	1 27	1 16	1 03	0 48	0 31	0 10	23 13

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
May	17	23 01	23 07	23 14	23 21	23 29	23 38	23 47	23 58	.. ..	.. ..	0 14	0 42	1 23	** **
	18	23 41	23 46	23 51	23 57	.. ..	.. ..	.. ..	.. ..	0 10	0 24	0 41	1 01	1 26	2 01
	19	.. ..	.. ..	.. ..	.. ..	0 03	0 10	0 17	0 25	0 34	0 44	0 56	1 09	1 25	1 45
	20	0 15	0 18	0 22	0 26	0 30	0 34	0 39	0 45	0 51	0 57	1 05	1 13	1 23	1 34
	21	0 43	0 45	0 47	0 49	0 52	0 54	0 57	1 00	1 03	1 07	1 11	1 15	1 20	1 26
	22	1 09	1 10	1 10	1 11	1 11	1 12	1 12	1 13	1 14	1 14	1 15	1 16	1 17	1 18
	23	1 34	1 33	1 32	1 31	1 30	1 28	1 27	1 25	1 23	1 21	1 19	1 17	1 14	1 11
	24	1 59	1 57	1 54	1 52	1 49	1 45	1 42	1 38	1 34	1 29	1 24	1 18	1 11	1 03
	25	2 26	2 22	2 18	2 14	2 09	2 04	1 58	1 52	1 46	1 38	1 29	1 19	1 08	0 54
	26	2 56	2 51	2 45	2 39	2 33	2 26	2 18	2 10	2 00	1 49	1 37	1 22	1 05	0 43
	27	3 30	3 24	3 17	3 10	3 02	2 53	2 43	2 32	2 20	2 06	1 49	1 29	1 03	0 27
	28	4 09	4 02	3 54	3 46	3 37	3 27	3 15	3 02	2 47	2 30	2 09	1 41	1 02	-- --
	29	4 55	4 47	4 39	4 30	4 20	4 09	3 56	3 42	3 26	3 06	2 41	2 08	1 09	-- --
	30	5 46	5 38	5 30	5 21	5 11	5 00	4 48	4 34	4 17	3 58	3 33	2 59	1 59	-- --
	31	6 42	6 35	6 27	6 19	6 10	6 00	5 49	5 36	5 21	5 03	4 42	4 14	3 34	-- --
June	1	7 41	7 35	7 28	7 21	7 13	7 05	6 55	6 44	6 32	6 18	6 01	5 40	5 14	4 36
	2	8 41	8 36	8 31	8 25	8 19	8 12	8 05	7 56	7 47	7 36	7 24	7 09	6 51	6 29
	3	9 42	9 38	9 35	9 30	9 26	9 21	9 16	9 10	9 03	8 56	8 47	8 37	8 26	8 12
	4	10 43	10 41	10 38	10 36	10 33	10 30	10 27	10 23	10 19	10 15	10 10	10 04	9 57	9 50
	5	11 45	11 44	11 43	11 42	11 41	11 40	11 39	11 38	11 36	11 35	11 33	11 31	11 29	11 26
	6	12 48	12 49	12 49	12 50	12 51	12 52	12 53	12 54	12 55	12 57	12 58	13 00	13 02	13 04
	7	13 54	13 56	13 58	14 01	14 04	14 07	14 10	14 13	14 17	14 22	14 27	14 33	14 39	14 47
	8	15 03	15 07	15 11	15 15	15 20	15 25	15 31	15 37	15 44	15 52	16 01	16 12	16 24	16 39
	9	16 16	16 22	16 27	16 34	16 40	16 48	16 56	17 05	17 16	17 27	17 41	17 58	18 18	18 44
	10	17 32	17 38	17 46	17 53	18 02	18 12	18 22	18 34	18 48	19 04	19 24	19 48	20 22	21 19

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
June	8	3 00	2 47	2 38	2 30	2 23	2 17	2 06	1 58	1 49	1 41	1 32	1 22	1 17	1 10
	9	4 28	4 08	3 53	3 41	3 31	3 22	3 06	2 53	2 40	2 28	2 15	2 00	1 51	1 41
	10	5 59	5 32	5 12	4 56	4 42	4 30	4 10	3 53	3 36	3 20	3 03	2 43	2 32	2 19
	11	7 28	6 55	6 31	6 11	5 55	5 41	5 17	4 57	4 38	4 19	3 59	3 35	3 22	3 06
	12	8 45	8 09	7 43	7 22	7 05	6 50	6 25	6 03	5 43	5 23	5 01	4 36	4 21	4 04
	13	9 41	9 09	8 44	8 25	8 08	7 54	7 30	7 09	6 49	6 29	6 08	5 44	5 30	5 13
	14	10 19	9 53	9 33	9 16	9 02	8 50	8 29	8 10	7 53	7 36	7 17	6 56	6 43	6 29
	15	10 45	10 25	10 10	9 57	9 47	9 37	9 21	9 06	8 53	8 39	8 24	8 08	7 58	7 47
	16	11 03	10 50	10 40	10 31	10 24	10 18	10 06	9 56	9 47	9 38	9 28	9 16	9 10	9 02
	17	11 16	11 10	11 05	11 00	10 57	10 53	10 47	10 42	10 37	10 32	10 27	10 21	10 18	10 14
	18	11 28	11 28	11 27	11 27	11 26	11 26	11 25	11 25	11 25	11 24	11 24	11 23	11 23	11 23
	19	11 40	11 45	11 49	11 52	11 55	11 57	12 02	12 06	12 10	12 14	12 18	12 23	12 26	12 29
	20	11 52	12 02	12 10	12 18	12 24	12 29	12 39	12 47	12 55	13 03	13 11	13 21	13 27	13 33
	21	12 05	12 21	12 34	12 45	12 54	13 02	13 16	13 29	13 40	13 52	14 04	14 19	14 27	14 37
	22	12 22	12 44	13 01	13 15	13 27	13 38	13 56	14 12	14 27	14 42	14 58	15 17	15 27	15 40
	23	12 45	13 12	13 33	13 50	14 04	14 17	14 39	14 57	15 15	15 33	15 51	16 13	16 26	16 41
	24	13 15	13 47	14 11	14 30	14 47	15 01	15 24	15 45	16 04	16 24	16 45	17 09	17 23	17 40
	25	13 57	14 31	14 57	15 17	15 34	15 48	16 13	16 35	16 55	17 15	17 36	18 01	18 16	18 33
	26	14 50	15 24	15 49	16 09	16 26	16 40	17 04	17 25	17 45	18 05	18 26	18 50	19 04	19 21
	27	15 55	16 25	16 47	17 06	17 21	17 34	17 57	18 16	18 34	18 52	19 12	19 34	19 47	20 02
	28	17 05	17 30	17 49	18 05	18 18	18 30	18 49	19 06	19 22	19 37	19 54	20 13	20 24	20 37
	29	18 19	18 38	18 53	19 06	19 16	19 25	19 41	19 54	20 07	20 20	20 33	20 48	20 57	21 07
	30	19 34	19 47	19 57	20 06	20 14	20 20	20 32	20 41	20 51	21 00	21 09	21 21	21 27	21 34
July	1	20 48	20 56	21 02	21 07	21 11	21 15	21 22	21 28	21 33	21 38	21 44	21 51	21 54	21 59
	2	22 03	22 05	22 07	22 08	22 09	22 10	22 12	22 14	22 15	22 17	22 18	22 20	22 21	22 22

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
June	8	12 48	13 02	13 14	13 23	13 32	13 39	13 51	14 02	14 13	14 23	14 34	14 47	14 55	15 03
	9	13 07	13 27	13 44	13 57	14 09	14 19	14 37	14 52	15 06	15 21	15 36	15 54	16 04	16 16
	10	13 33	14 01	14 22	14 39	14 54	15 07	15 28	15 47	16 05	16 23	16 42	17 04	17 17	17 32
	11	14 13	14 46	15 11	15 31	15 48	16 03	16 27	16 49	17 08	17 28	17 49	18 14	18 29	18 45
	12	15 13	15 48	16 14	16 35	16 52	17 07	17 33	17 54	18 14	18 35	18 56	19 21	19 36	19 53
	13	16 33	17 05	17 29	17 48	18 04	18 18	18 41	19 01	19 20	19 38	19 58	20 21	20 34	20 49
	14	18 06	18 31	18 50	19 06	19 19	19 30	19 50	20 06	20 22	20 37	20 54	21 12	21 23	21 36
	15	19 40	19 58	20 12	20 23	20 32	20 41	20 55	21 07	21 19	21 30	21 43	21 56	22 04	22 13
	16	21 11	21 22	21 30	21 37	21 43	21 48	21 57	22 04	22 11	22 19	22 26	22 34	22 39	22 45
	17	22 38	22 41	22 45	22 47	22 49	22 51	22 55	22 57	23 00	23 03	23 05	23 09	23 10	23 12
	18	.. ..	23 58	23 56	23 54	23 53	23 52	23 50	23 48	23 46	23 45	23 43	23 41	23 39	23 38
	19	0 00	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
	20	1 20	1 12	1 05	1 00	0 55	0 51	0 44	0 37	0 31	0 25	0 19	0 12	0 08	0 03
	21	2 39	2 25	2 13	2 04	1 56	1 49	1 37	1 26	1 16	1 07	0 56	0 44	0 37	0 30
	22	3 57	3 36	3 20	3 07	2 56	2 47	2 30	2 16	2 02	1 49	1 35	1 19	1 09	0 58
	23	5 12	4 46	4 26	4 10	3 56	3 44	3 24	3 06	2 50	2 33	2 16	1 56	1 44	1 31
	24	6 23	5 52	5 28	5 10	4 54	4 40	4 17	3 57	3 39	3 20	3 00	2 37	2 24	2 08
	25	7 25	6 51	6 26	6 06	5 49	5 35	5 10	4 49	4 29	4 09	3 48	3 23	3 08	2 52
	26	8 16	7 42	7 17	6 57	6 40	6 25	6 01	5 39	5 19	4 59	4 38	4 13	3 58	3 41
	27	8 54	8 23	8 00	7 41	7 25	7 12	6 48	6 28	6 09	5 50	5 30	5 06	4 52	4 36
	28	9 21	8 55	8 35	8 19	8 05	7 53	7 32	7 14	6 57	6 40	6 22	6 01	5 48	5 34
	29	9 42	9 21	9 05	8 52	8 40	8 30	8 13	7 58	7 44	7 29	7 14	6 56	6 46	6 34
	30	9 57	9 42	9 30	9 20	9 11	9 04	8 51	8 39	8 28	8 17	8 05	7 52	7 44	7 35
July	1	10 10	10 00	9 52	9 46	9 40	9 35	9 26	9 18	9 11	9 04	8 56	8 47	8 41	8 35
	2	10 20	10 16	10 12	10 09	10 07	10 04	10 00	9 57	9 53	9 50	9 46	9 42	9 39	9 36

(.. ..) indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
June	8	1 10	1 07	1 04	1 01	0 58	0 54	0 50	0 45	0 40	0 35	0 29	0 22	0 14	0 04
	9	1 41	1 37	1 32	1 27	1 22	1 16	1 10	1 03	0 55	0 46	0 36	0 25	0 11	23 43
	10	2 19	2 13	2 07	2 00	1 53	1 45	1 36	1 27	1 16	1 03	0 48	0 31	0 10	23 13
	11	3 06	2 59	2 52	2 43	2 34	2 25	2 14	2 01	1 47	1 30	1 10	0 45	0 11	** **
	12	4 04	3 57	3 48	3 39	3 29	3 18	3 06	2 52	2 36	2 16	1 52	1 19	0 26	** **
	13	5 13	5 06	4 58	4 49	4 39	4 28	4 16	4 03	3 47	3 28	3 04	2 33	1 43	** **
	14	6 29	6 23	6 16	6 08	6 00	5 50	5 40	5 29	5 15	5 00	4 42	4 19	3 48	3 01
	15	7 47	7 42	7 36	7 30	7 24	7 17	7 09	7 01	6 51	6 40	6 28	6 13	5 54	5 31
	16	9 02	8 59	8 55	8 51	8 47	8 42	8 37	8 32	8 26	8 19	8 11	8 02	7 51	7 38
	17	10 14	10 12	10 10	10 08	10 06	10 04	10 01	9 59	9 56	9 52	9 48	9 44	9 39	9 33
	18	11 23	11 22	11 22	11 22	11 22	11 22	11 22	11 21	11 21	11 21	11 21	11 20	11 20	11 20
	19	12 29	12 30	12 32	12 33	12 35	12 37	12 39	12 41	12 44	12 46	12 50	12 53	12 57	13 02
	20	13 33	13 36	13 39	13 43	13 46	13 50	13 54	13 59	14 04	14 10	14 17	14 25	14 34	14 44
	21	14 37	14 41	14 46	14 51	14 56	15 02	15 09	15 16	15 24	15 33	15 44	15 56	16 11	16 29
	22	15 40	15 46	15 52	15 58	16 05	16 13	16 22	16 32	16 43	16 55	17 10	17 28	17 50	18 20
	23	16 41	16 48	16 55	17 03	17 12	17 21	17 32	17 44	17 58	18 14	18 34	18 58	19 32	20 33
	24	17 40	17 47	17 55	18 04	18 13	18 24	18 36	18 50	19 06	19 25	19 49	20 21	21 13	-- --
	25	18 33	18 41	18 49	18 58	19 08	19 19	19 32	19 46	20 03	20 23	20 48	21 23	22 28	-- --
	26	19 21	19 28	19 36	19 45	19 54	20 05	20 17	20 31	20 46	21 05	21 28	21 58	22 45	-- --
	27	20 02	20 08	20 16	20 24	20 32	20 42	20 52	21 04	21 17	21 33	21 52	22 15	22 46	23 34
	28	20 37	20 43	20 49	20 55	21 02	21 10	21 19	21 29	21 39	21 52	22 06	22 23	22 44	23 11
	29	21 07	21 12	21 17	21 22	21 27	21 33	21 40	21 47	21 55	22 05	22 15	22 27	22 42	22 59
	30	21 34	21 37	21 41	21 44	21 48	21 53	21 57	22 02	22 08	22 14	22 21	22 29	22 39	22 49
July	1	21 59	22 01	22 03	22 05	22 07	22 09	22 12	22 15	22 18	22 22	22 26	22 30	22 35	22 41
	2	22 22	22 23	22 23	22 24	22 24	22 25	22 26	22 27	22 28	22 29	22 30	22 31	22 32	22 34

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
June	8	15 03	15 07	15 11	15 15	15 20	15 25	15 31	15 37	15 44	15 52	16 01	16 12	16 24	16 39
	9	16 16	16 22	16 27	16 34	16 40	16 48	16 56	17 05	17 16	17 27	17 41	17 58	18 18	18 44
	10	17 32	17 38	17 46	17 53	18 02	18 12	18 22	18 34	18 48	19 04	19 24	19 48	20 22	21 19
	11	18 45	18 53	19 01	19 10	19 20	19 31	19 43	19 57	20 13	20 33	20 57	21 29	22 22	** **
	12	19 53	20 00	20 08	20 17	20 27	20 38	20 50	21 04	21 20	21 39	22 03	22 35	23 25	** **
	13	20 49	20 56	21 04	21 12	21 20	21 30	21 40	21 52	22 06	22 22	22 41	23 04	23 35	** **
	14	21 36	21 41	21 47	21 53	22 00	22 08	22 16	22 25	22 36	22 47	23 01	23 17	23 36	0 23
	15	22 13	22 17	22 21	22 26	22 31	22 36	22 42	22 48	22 55	23 03	23 12	23 23	23 34	0 00
	16	22 45	22 47	22 50	22 52	22 55	22 58	23 02	23 06	23 10	23 14	23 20	23 25	23 32	23 40
	17	23 12	23 13	23 14	23 15	23 16	23 17	23 19	23 20	23 21	23 23	23 25	23 27	23 29	23 32
	18	23 38	23 37	23 37	23 36	23 35	23 35	23 34	23 33	23 32	23 31	23 29	23 28	23 26	23 24
	19	.. ..	.. ..	23 59	23 57	23 54	23 52	23 49	23 45	23 42	23 38	23 34	23 29	23 23	23 17
	20	0 03	0 01	.. ..	.. ..	.. ..	.. ..	.. ..	23 59	23 53	23 47	23 39	23 30	23 20	23 08
	21	0 30	0 26	0 23	0 19	0 14	0 10	0 05	.. ..	.. ..	23 57	23 46	23 33	23 17	22 58
	22	0 58	0 54	0 49	0 43	0 37	0 31	0 24	0 16	0 07	.. ..	23 56	23 38	23 15	22 44
	23	1 31	1 25	1 18	1 12	1 04	0 56	0 47	0 36	0 25	0 12	.. ..	23 48	23 13	22 12
	24	2 08	2 01	1 54	1 46	1 37	1 27	1 16	1 04	0 50	0 33	0 13	.. ..	23 16	-- --
	25	2 52	2 44	2 36	2 27	2 17	2 06	1 54	1 40	1 24	1 05	0 41	0 09	23 47	-- --
	26	3 41	3 33	3 25	3 16	3 06	2 55	2 42	2 28	2 11	1 51	1 26	0 52	.. ..	-- --
	27	4 36	4 28	4 21	4 12	4 03	3 52	3 40	3 27	3 12	2 53	2 30	2 00	1 14	-- --
	28	5 34	5 28	5 21	5 13	5 05	4 56	4 45	4 34	4 21	4 06	3 47	3 24	2 54	2 07
	29	6 34	6 29	6 23	6 17	6 10	6 03	5 55	5 45	5 35	5 23	5 10	4 53	4 33	4 07
	30	7 35	7 31	7 26	7 22	7 17	7 11	7 05	6 58	6 51	6 43	6 33	6 22	6 08	5 52
July	1	8 35	8 33	8 30	8 27	8 24	8 20	8 16	8 12	8 07	8 02	7 55	7 48	7 40	7 31
	2	9 36	9 35	9 34	9 32	9 31	9 29	9 27	9 25	9 23	9 20	9 18	9 14	9 11	9 06

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	1	20 48	20 56	21 02	21 07	21 11	21 15	21 22	21 28	21 33	21 38	21 44	21 51	21 54	21 59
	2	22 03	22 05	22 07	22 08	22 09	22 10	22 12	22 14	22 15	22 17	22 18	22 20	22 21	22 22
	3	23 20	23 16	23 13	23 10	23 08	23 06	23 03	23 00	22 58	22 55	22 52	22 49	22 48	22 46
	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 56	23 49	23 42	23 36	23 29	23 21	23 16	23 11
	5	0 39	0 29	0 21	0 15	0 09	0 05	.. ..	.. ..	.. ..	.. ..	.. ..	23 55	23 48	23 39
	6	2 02	1 46	1 33	1 23	1 14	1 06	0 52	0 41	0 30	0 19	0 08	.. ..	.. ..	.. ..
	7	3 29	3 06	2 48	2 34	2 21	2 11	1 52	1 37	1 22	1 08	0 52	0 34	0 24	0 13
	8	4 58	4 28	4 05	3 47	3 32	3 19	2 56	2 37	2 19	2 01	1 43	1 21	1 08	0 54
	9	6 20	5 45	5 19	4 59	4 42	4 27	4 02	3 41	3 21	3 01	2 40	2 16	2 01	1 45
	10	7 26	6 52	6 26	6 05	5 48	5 33	5 08	4 47	4 26	4 06	3 45	3 20	3 05	2 48
	11	8 13	7 43	7 21	7 02	6 47	6 33	6 10	5 50	5 32	5 13	4 53	4 30	4 16	4 01
	12	8 45	8 22	8 04	7 49	7 36	7 25	7 07	6 50	6 34	6 19	6 02	5 43	5 32	5 19
	13	9 06	8 50	8 38	8 27	8 18	8 10	7 56	7 44	7 33	7 21	7 09	6 55	6 47	6 37
	14	9 22	9 13	9 06	8 59	8 54	8 49	8 41	8 34	8 27	8 20	8 12	8 04	7 59	7 53
	15	9 35	9 32	9 30	9 28	9 26	9 24	9 21	9 19	9 17	9 14	9 12	9 09	9 08	9 06
	16	9 47	9 50	9 52	9 54	9 56	9 57	10 00	10 02	10 04	10 06	10 09	10 12	10 13	10 15
	17	9 59	10 08	10 14	10 20	10 25	10 30	10 37	10 44	10 51	10 57	11 04	11 12	11 17	11 22
	18	10 12	10 27	10 38	10 47	10 56	11 03	11 15	11 26	11 37	11 47	11 58	12 11	12 19	12 28
	19	10 28	10 48	11 04	11 17	11 28	11 38	11 55	12 10	12 24	12 38	12 53	13 10	13 20	13 32
	20	10 49	11 15	11 34	11 51	12 04	12 16	12 37	12 55	13 11	13 28	13 47	14 08	14 20	14 34
	21	11 17	11 47	12 10	12 29	12 45	12 58	13 22	13 42	14 01	14 20	14 40	15 04	15 18	15 34
	22	11 54	12 28	12 53	13 14	13 30	13 45	14 10	14 31	14 51	15 11	15 32	15 57	16 12	16 29
	23	12 44	13 18	13 44	14 04	14 21	14 35	15 00	15 21	15 41	16 01	16 22	16 47	17 02	17 18
	24	13 45	14 17	14 40	14 59	15 15	15 29	15 52	16 12	16 31	16 49	17 09	17 32	17 46	18 02
	25	14 54	15 21	15 41	15 58	16 12	16 24	16 44	17 02	17 19	17 35	17 53	18 13	18 25	18 39

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	1	10 10	10 00	9 52	9 46	9 40	9 35	9 26	9 18	9 11	9 04	8 56	8 47	8 41	8 35
	2	10 20	10 16	10 12	10 09	10 07	10 04	10 00	9 57	9 53	9 50	9 46	9 42	9 39	9 36
	3	10 31	10 32	10 32	10 33	10 33	10 34	10 34	10 35	10 35	10 36	10 36	10 37	10 37	10 38
	4	10 41	10 48	10 53	10 57	11 00	11 04	11 09	11 14	11 19	11 23	11 28	11 34	11 37	11 41
	5	10 54	11 06	11 15	11 23	11 30	11 36	11 47	11 56	12 05	12 13	12 23	12 34	12 40	12 47
	6	11 09	11 27	11 42	11 53	12 04	12 13	12 28	12 42	12 54	13 07	13 21	13 36	13 46	13 56
	7	11 31	11 55	12 15	12 30	12 43	12 55	13 15	13 32	13 49	14 05	14 22	14 43	14 55	15 08
	8	12 03	12 34	12 57	13 16	13 32	13 45	14 09	14 29	14 48	15 07	15 28	15 51	16 05	16 21
	9	12 51	13 26	13 52	14 13	14 30	14 45	15 10	15 32	15 52	16 12	16 34	16 59	17 14	17 31
	10	14 01	14 35	15 01	15 21	15 38	15 52	16 17	16 38	16 58	17 17	17 38	18 02	18 16	18 33
	11	15 29	15 58	16 19	16 37	16 52	17 04	17 26	17 45	18 02	18 19	18 38	18 58	19 11	19 25
	12	17 05	17 26	17 43	17 56	18 07	18 17	18 34	18 49	19 03	19 16	19 31	19 47	19 56	20 07
	13	18 40	18 54	19 05	19 14	19 21	19 28	19 40	19 50	19 59	20 08	20 18	20 29	20 35	20 42
	14	20 12	20 18	20 24	20 28	20 32	20 35	20 41	20 46	20 51	20 55	21 00	21 06	21 09	21 12
	15	21 39	21 39	21 39	21 39	21 39	21 39	21 39	21 39	21 40	21 40	21 40	21 40	21 40	21 39
	16	23 02	22 56	22 51	22 47	22 44	22 41	22 35	22 31	22 26	22 22	22 17	22 12	22 09	22 06
	17	.. ..	.. ..	.. ..	23 54	23 47	23 41	23 30	23 21	23 13	23 04	22 55	22 45	22 39	22 32
	18	0 24	0 12	0 02	.. ..	.. ..	.. ..	.. ..	.. ..	23 59	23 47	23 34	23 19	23 10	23 01
	19	1 43	1 25	1 10	0 59	0 48	0 40	0 24	0 11	.. ..	.. ..	.. ..	23 56	23 45	23 32
	20	3 01	2 36	2 17	2 02	1 49	1 38	1 19	1 02	0 46	0 31	0 14	.. ..	.. ..	.. ..
	21	4 14	3 44	3 21	3 03	2 48	2 35	2 12	1 53	1 35	1 17	0 58	0 36	0 23	0 08
	22	5 19	4 46	4 21	4 01	3 44	3 30	3 05	2 44	2 25	2 05	1 44	1 20	1 06	0 49
	23	6 13	5 39	5 14	4 53	4 36	4 22	3 57	3 35	3 15	2 55	2 34	2 09	1 54	1 37
	24	6 55	6 23	5 59	5 40	5 23	5 09	4 45	4 25	4 05	3 46	3 25	3 01	2 46	2 30
	25	7 26	6 58	6 37	6 20	6 05	5 52	5 31	5 12	4 54	4 36	4 17	3 55	3 42	3 27

(.. ..) indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	1	21 59	22 01	22 03	22 05	22 07	22 09	22 12	22 15	22 18	22 22	22 26	22 30	22 35	22 41
	2	22 22	22 23	22 23	22 24	22 24	22 25	22 26	22 27	22 28	22 29	22 30	22 31	22 32	22 34
	3	22 46	22 45	22 44	22 43	22 42	22 41	22 40	22 38	22 37	22 35	22 33	22 31	22 29	22 27
	4	23 11	23 09	23 06	23 04	23 01	22 58	22 55	22 51	22 47	22 43	22 38	22 32	22 26	22 19
	5	23 39	23 35	23 32	23 27	23 23	23 18	23 12	23 06	23 00	22 52	22 44	22 35	22 24	22 11
	6	.. ..	.. ..	.. ..	23 56	23 50	23 43	23 35	23 26	23 17	23 06	22 53	22 39	22 22	22 00
	7	0 13	0 07	0 02	.. ..	.. ..	.. ..	.. ..	23 54	23 41	23 27	23 09	22 48	22 21	21 43
	8	0 54	0 47	0 40	0 33	0 24	0 15	0 05	.. ..	.. ..	.. ..	23 39	23 10	22 26	** **
	9	1 45	1 38	1 30	1 21	1 11	1 01	0 49	0 35	0 20	0 01	.. ..	.. ..	23 02	** **
	10	2 48	2 40	2 32	2 23	2 13	2 02	1 49	1 35	1 18	0 59	0 34	0 00	.. ..	** **
	11	4 01	3 53	3 46	3 37	3 28	3 18	3 07	2 54	2 39	2 22	2 00	1 33	0 53	** **
	12	5 19	5 13	5 07	5 00	4 52	4 44	4 35	4 25	4 14	4 01	3 45	3 26	3 02	2 30
	13	6 37	6 33	6 29	6 24	6 19	6 13	6 07	6 00	5 52	5 43	5 33	5 21	5 07	4 50
	14	7 53	7 51	7 48	7 45	7 42	7 39	7 35	7 31	7 27	7 22	7 16	7 10	7 02	6 53
	15	9 06	9 05	9 04	9 03	9 02	9 01	9 00	8 59	8 57	8 56	8 54	8 52	8 50	8 47
	16	10 15	10 16	10 17	10 18	10 19	10 20	10 21	10 22	10 24	10 25	10 27	10 29	10 32	10 34
	17	11 22	11 25	11 27	11 30	11 33	11 36	11 39	11 43	11 47	11 52	11 58	12 04	12 11	12 19
	18	12 28	12 31	12 36	12 40	12 45	12 50	12 56	13 02	13 09	13 17	13 27	13 37	13 50	14 05
	19	13 32	13 37	13 43	13 49	13 55	14 02	14 10	14 19	14 29	14 41	14 54	15 10	15 30	15 55
	20	14 34	14 41	14 47	14 55	15 03	15 12	15 22	15 34	15 47	16 02	16 20	16 42	17 12	17 58
	21	15 34	15 41	15 49	15 57	16 07	16 17	16 29	16 42	16 58	17 16	17 39	18 08	18 54	-- --
	22	16 29	16 37	16 45	16 54	17 04	17 15	17 28	17 42	17 58	18 19	18 44	19 18	20 24	-- --
	23	17 18	17 26	17 34	17 43	17 53	18 04	18 16	18 30	18 46	19 06	19 30	20 02	20 56	-- --
	24	18 02	18 09	18 16	18 24	18 33	18 43	18 54	19 07	19 21	19 38	19 58	20 24	20 59	22 05
	25	18 39	18 45	18 51	18 58	19 06	19 14	19 23	19 34	19 46	19 59	20 15	20 34	20 58	21 29

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	1	8 35	8 33	8 30	8 27	8 24	8 20	8 16	8 12	8 07	8 02	7 55	7 48	7 40	7 31
	2	9 36	9 35	9 34	9 32	9 31	9 29	9 27	9 25	9 23	9 20	9 18	9 14	9 11	9 06
	3	10 38	10 38	10 38	10 38	10 39	10 39	10 39	10 39	10 40	10 40	10 40	10 41	10 41	10 42
	4	11 41	11 43	11 44	11 46	11 48	11 50	11 53	11 56	11 58	12 02	12 05	12 10	12 14	12 20
	5	12 47	12 50	12 53	12 57	13 01	13 05	13 10	13 15	13 21	13 27	13 35	13 43	13 53	14 04
	6	13 56	14 01	14 06	14 11	14 17	14 24	14 31	14 39	14 47	14 57	15 09	15 23	15 39	16 00
	7	15 08	15 14	15 21	15 28	15 36	15 44	15 54	16 05	16 17	16 31	16 48	17 09	17 35	18 13
	8	16 21	16 28	16 36	16 45	16 54	17 04	17 16	17 29	17 45	18 03	18 25	18 54	19 37	** **
	9	17 31	17 39	17 47	17 56	18 06	18 17	18 29	18 44	19 00	19 20	19 45	20 18	21 16	** **
	10	18 33	18 40	18 48	18 57	19 06	19 16	19 28	19 41	19 56	20 14	20 36	21 04	21 44	** **
	11	19 25	19 31	19 38	19 45	19 53	20 01	20 11	20 21	20 34	20 47	21 04	21 23	21 48	22 21
	12	20 07	20 12	20 17	20 22	20 28	20 35	20 42	20 49	20 58	21 08	21 19	21 32	21 47	22 05
	13	20 42	20 45	20 49	20 52	20 56	21 00	21 05	21 10	21 15	21 21	21 28	21 36	21 45	21 55
	14	21 12	21 14	21 15	21 17	21 19	21 21	21 23	21 26	21 28	21 31	21 34	21 38	21 42	21 47
	15	21 39	21 39	21 39	21 39	21 39	21 39	21 39	21 39	21 39	21 39	21 39	21 39	21 39	21 39
	16	22 06	22 04	22 03	22 01	21 59	21 57	21 55	21 53	21 50	21 47	21 44	21 40	21 36	21 31
	17	22 32	22 29	22 26	22 23	22 19	22 15	22 11	22 06	22 01	21 55	21 49	21 42	21 33	21 23
	18	23 01	22 56	22 52	22 47	22 41	22 35	22 29	22 22	22 14	22 05	21 55	21 44	21 30	21 14
	19	23 32	23 26	23 20	23 14	23 07	22 59	22 51	22 41	22 31	22 19	22 04	21 48	21 28	21 02
	20	.. ..	.. ..	23 54	23 46	23 38	23 28	23 18	23 06	22 53	22 37	22 19	21 56	21 26	20 40
	21	0 08	0 01	.. ..	.. ..	.. ..	.. ..	23 53	23 40	23 24	23 05	22 43	22 13	21 26	-- --
	22	0 49	0 42	0 34	0 25	0 16	0 05	.. ..	.. ..	.. ..	23 47	23 22	22 47	21 42	-- --
	23	1 37	1 29	1 21	1 12	1 02	0 51	0 38	0 24	0 07	.. ..	.. ..	23 48	22 54	-- --
	24	2 30	2 22	2 14	2 05	1 56	1 45	1 33	1 19	1 03	0 44	0 20	.. ..	.. ..	23 27
	25	3 27	3 20	3 13	3 05	2 56	2 47	2 36	2 24	2 10	1 53	1 33	1 08	0 33	.. ..

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	24	13 45	14 17	14 40	14 59	15 15	15 29	15 52	16 12	16 31	16 49	17 09	17 32	17 46	18 02
	25	14 54	15 21	15 41	15 58	16 12	16 24	16 44	17 02	17 19	17 35	17 53	18 13	18 25	18 39
	26	16 08	16 29	16 45	16 58	17 10	17 20	17 37	17 51	18 05	18 19	18 33	18 50	19 00	19 11
	27	17 22	17 38	17 50	17 59	18 08	18 15	18 28	18 39	18 49	19 00	19 11	19 23	19 30	19 39
	28	18 37	18 47	18 54	19 00	19 06	19 10	19 19	19 26	19 32	19 39	19 46	19 54	19 59	20 04
	29	19 52	19 56	19 59	20 02	20 04	20 06	20 09	20 12	20 15	20 17	20 20	20 24	20 25	20 28
	30	21 08	21 06	21 05	21 03	21 02	21 01	21 00	20 58	20 57	20 56	20 54	20 53	20 52	20 51
	31	22 25	22 18	22 12	22 06	22 02	21 58	21 52	21 46	21 40	21 35	21 29	21 23	21 19	21 15
Aug.	1	23 46	23 32	23 21	23 12	23 04	22 57	22 46	22 36	22 26	22 17	22 07	21 56	21 49	21 42
	2	.. ..	.. ..	.. ..	.. ..	.. ..	23 59	23 43	23 29	23 15	23 02	22 48	22 32	22 23	22 12
	3	1 10	0 49	0 33	0 20	0 09	.. ..	.. ..	.. ..	.. ..	23 52	23 34	23 14	23 03	22 49
	4	2 35	2 08	1 47	1 30	1 16	1 04	0 43	0 25	0 09	.. ..	.. ..	.. ..	23 50	23 34
	5	3 58	3 25	3 00	2 41	2 24	2 10	1 46	1 26	1 07	0 48	0 27	0 04	.. ..	.. ..
	6	5 10	4 34	4 08	3 48	3 30	3 16	2 50	2 29	2 08	1 48	1 27	1 02	0 47	0 30
	7	6 04	5 32	5 07	4 48	4 31	4 17	3 53	3 32	3 12	2 53	2 32	2 07	1 53	1 36
	8	6 42	6 15	5 55	5 38	5 24	5 12	4 51	4 32	4 15	3 58	3 39	3 18	3 05	2 51
	9	7 08	6 48	6 33	6 20	6 09	6 00	5 43	5 29	5 15	5 01	4 47	4 30	4 20	4 09
	10	7 27	7 14	7 04	6 55	6 48	6 42	6 30	6 21	6 11	6 02	5 52	5 41	5 34	5 26
	11	7 41	7 35	7 30	7 26	7 22	7 19	7 13	7 08	7 04	6 59	6 54	6 49	6 45	6 42
	12	7 54	7 54	7 54	7 54	7 54	7 54	7 54	7 54	7 54	7 54	7 54	7 54	7 54	7 54
	13	8 06	8 12	8 17	8 21	8 24	8 27	8 33	8 37	8 42	8 46	8 51	8 57	9 00	9 04
	14	8 19	8 31	8 40	8 48	8 55	9 01	9 11	9 21	9 29	9 38	9 48	9 58	10 05	10 12
	15	8 35	8 52	9 06	9 18	9 27	9 36	9 51	10 05	10 17	10 30	10 43	10 59	11 08	11 18
	16	8 54	9 17	9 35	9 50	10 03	10 14	10 33	10 50	11 06	11 21	11 38	11 58	12 10	12 23
	17	9 19	9 48	10 10	10 27	10 42	10 55	11 18	11 37	11 55	12 13	12 33	12 56	13 09	13 25

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	24	6 55	6 23	5 59	5 40	5 23	5 09	4 45	4 25	4 05	3 46	3 25	3 01	2 46	2 30
	25	7 26	6 58	6 37	6 20	6 05	5 52	5 31	5 12	4 54	4 36	4 17	3 55	3 42	3 27
	26	7 48	7 26	7 08	6 54	6 42	6 31	6 13	5 57	5 41	5 26	5 10	4 51	4 40	4 27
	27	8 05	7 48	7 35	7 24	7 14	7 06	6 51	6 39	6 27	6 15	6 02	5 47	5 38	5 28
	28	8 19	8 07	7 58	7 50	7 44	7 38	7 28	7 19	7 10	7 02	6 53	6 42	6 36	6 29
	29	8 30	8 24	8 19	8 15	8 11	8 08	8 02	7 57	7 53	7 48	7 43	7 37	7 34	7 30
	30	8 40	8 39	8 39	8 38	8 38	8 37	8 36	8 36	8 35	8 34	8 33	8 32	8 32	8 31
	31	8 51	8 55	8 59	9 02	9 04	9 07	9 11	9 14	9 18	9 21	9 24	9 28	9 31	9 33
Aug.	1	9 02	9 12	9 20	9 27	9 33	9 38	9 47	9 55	10 02	10 09	10 17	10 26	10 32	10 37
	2	9 16	9 32	9 45	9 55	10 04	10 12	10 26	10 38	10 49	11 00	11 13	11 27	11 35	11 44
	3	9 35	9 57	10 14	10 28	10 40	10 51	11 09	11 25	11 40	11 55	12 11	12 30	12 41	12 53
	4	10 01	10 29	10 51	11 09	11 24	11 36	11 59	12 18	12 36	12 54	13 13	13 35	13 49	14 04
	5	10 40	11 14	11 39	11 59	12 16	12 30	12 55	13 16	13 36	13 56	14 17	14 42	14 56	15 13
	6	11 38	12 13	12 39	13 00	13 17	13 32	13 57	14 19	14 39	14 59	15 20	15 45	16 00	16 17
	7	12 56	13 28	13 52	14 11	14 26	14 40	15 04	15 24	15 42	16 01	16 21	16 43	16 57	17 12
	8	14 27	14 52	15 12	15 27	15 41	15 52	16 11	16 28	16 44	16 59	17 16	17 35	17 46	17 58
	9	16 03	16 21	16 34	16 46	16 55	17 04	17 18	17 31	17 42	17 54	18 06	18 20	18 28	18 37
	10	17 37	17 47	17 56	18 02	18 08	18 13	18 22	18 30	18 37	18 44	18 51	18 59	19 04	19 09
	11	19 08	19 11	19 14	19 16	19 18	19 20	19 23	19 25	19 28	19 30	19 32	19 35	19 37	19 38
	12	20 35	20 32	20 30	20 28	20 26	20 24	20 21	20 19	20 17	20 14	20 12	20 09	20 08	20 06
	13	22 00	21 51	21 43	21 37	21 31	21 27	21 18	21 11	21 04	20 58	20 51	20 43	20 38	20 33
	14	23 23	23 07	22 54	22 44	22 35	22 28	22 14	22 03	21 52	21 41	21 30	21 17	21 10	21 01
	15	.. ..	.. ..	.. ..	23 50	23 38	23 27	23 10	22 55	22 40	22 26	22 11	21 54	21 43	21 32
	16	0 43	0 21	0 04	.. ..	.. ..	.. ..	.. ..	23 46	23 29	23 12	22 54	22 33	22 21	22 07
	17	1 59	1 31	1 10	0 53	0 39	0 26	0 05	.. ..	.. ..	.. ..	23 40	23 16	23 03	22 47

(.. ..) indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	24	18 02	18 09	18 16	18 24	18 33	18 43	18 54	19 07	19 21	19 38	19 58	20 24	20 59	22 05
	25	18 39	18 45	18 51	18 58	19 06	19 14	19 23	19 34	19 46	19 59	20 15	20 34	20 58	21 29
	26	19 11	19 15	19 21	19 26	19 32	19 39	19 46	19 54	20 03	20 14	20 25	20 39	20 55	21 15
	27	19 39	19 42	19 46	19 50	19 55	19 59	20 05	20 11	20 17	20 24	20 32	20 42	20 52	21 05
	28	20 04	20 06	20 09	20 11	20 14	20 17	20 20	20 24	20 28	20 32	20 37	20 43	20 49	20 57
	29	20 28	20 29	20 30	20 31	20 32	20 33	20 34	20 36	20 37	20 39	20 41	20 44	20 46	20 49
	30	20 51	20 51	20 50	20 50	20 49	20 49	20 48	20 47	20 47	20 46	20 45	20 44	20 43	20 42
	31	21 15	21 14	21 12	21 10	21 07	21 05	21 02	21 00	20 57	20 53	20 49	20 45	20 40	20 34
Aug.	1	21 42	21 39	21 35	21 32	21 28	21 23	21 19	21 14	21 08	21 02	20 55	20 47	20 37	20 26
	2	22 12	22 08	22 03	21 58	21 52	21 46	21 39	21 31	21 23	21 13	21 02	20 50	20 35	20 17
	3	22 49	22 43	22 37	22 30	22 22	22 14	22 05	21 55	21 43	21 30	21 15	20 56	20 34	20 04
	4	23 34	23 27	23 20	23 11	23 02	22 52	22 41	22 29	22 14	21 57	21 37	21 11	20 35	19 29
	5	.. ..	.. ..	.. ..	.. ..	23 55	23 44	23 32	23 18	23 01	22 42	22 18	21 45	20 51	** **
	6	0 30	0 22	0 14	0 05	.. ..	.. ..	.. ..	.. ..	.. ..	23 51	23 27	22 56	22 06	** **
	7	1 36	1 29	1 21	1 12	1 02	0 52	0 40	0 26	0 10	.. ..	.. ..	.. ..	.. ..	23 21
	8	2 51	2 44	2 37	2 30	2 21	2 12	2 02	1 50	1 37	1 21	1 03	0 40	0 09	.. ..
	9	4 09	4 04	3 58	3 52	3 46	3 39	3 31	3 23	3 13	3 02	2 49	2 34	2 15	1 52
	10	5 26	5 23	5 19	5 15	5 11	5 07	5 02	4 56	4 50	4 43	4 35	4 26	4 15	4 03
	11	6 42	6 40	6 38	6 36	6 34	6 32	6 30	6 27	6 24	6 21	6 17	6 13	6 08	6 02
	12	7 54	7 54	7 54	7 54	7 54	7 54	7 54	7 54	7 54	7 54	7 55	7 55	7 55	7 55
	13	9 04	9 06	9 07	9 09	9 11	9 13	9 16	9 19	9 22	9 25	9 29	9 33	9 38	9 43
	14	10 12	10 15	10 19	10 22	10 26	10 31	10 35	10 41	10 47	10 53	11 01	11 09	11 19	11 31
	15	11 18	11 23	11 28	11 33	11 39	11 46	11 53	12 01	12 10	12 20	12 31	12 45	13 01	13 22
	16	12 23	12 29	12 35	12 42	12 50	12 58	13 07	13 18	13 30	13 43	14 00	14 19	14 44	15 19
	17	13 25	13 32	13 39	13 47	13 56	14 06	14 17	14 30	14 44	15 02	15 23	15 49	16 28	-- --

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	24	2 30	2 22	2 14	2 05	1 56	1 45	1 33	1 19	1 03	0 44	0 20	.. ..	.. ..	23 27
	25	3 27	3 20	3 13	3 05	2 56	2 47	2 36	2 24	2 10	1 53	1 33	1 08	0 33	.. ..
	26	4 27	4 21	4 15	4 08	4 01	3 53	3 44	3 34	3 23	3 10	2 55	2 36	2 13	1 42
	27	5 28	5 23	5 19	5 13	5 08	5 02	4 55	4 47	4 39	4 29	4 19	4 06	3 50	3 31
	28	6 29	6 26	6 22	6 19	6 15	6 11	6 06	6 01	5 55	5 49	5 42	5 34	5 24	5 12
	29	7 30	7 28	7 26	7 24	7 22	7 20	7 17	7 15	7 12	7 08	7 04	7 00	6 55	6 49
	30	8 31	8 31	8 31	8 30	8 30	8 29	8 29	8 29	8 28	8 28	8 27	8 26	8 25	8 24
	31	9 33	9 35	9 36	9 37	9 39	9 40	9 42	9 44	9 46	9 48	9 51	9 54	9 57	10 01
Aug.	1	10 37	10 40	10 43	10 46	10 49	10 53	10 57	11 01	11 06	11 11	11 17	11 24	11 32	11 42
	2	11 44	11 48	11 53	11 57	12 03	12 08	12 14	12 21	12 29	12 38	12 48	12 59	13 13	13 30
	3	12 53	12 59	13 05	13 11	13 18	13 26	13 35	13 44	13 55	14 08	14 23	14 40	15 02	15 31
	4	14 04	14 11	14 18	14 26	14 35	14 44	14 55	15 07	15 22	15 38	15 58	16 23	16 58	18 04
	5	15 13	15 20	15 29	15 37	15 47	15 58	16 10	16 24	16 41	17 00	17 24	17 57	18 51	** **
	6	16 17	16 24	16 32	16 41	16 51	17 02	17 14	17 28	17 44	18 03	18 27	18 58	19 48	** **
	7	17 12	17 19	17 26	17 34	17 43	17 52	18 03	18 15	18 29	18 45	19 04	19 27	19 59	20 47
	8	17 58	18 04	18 10	18 16	18 23	18 30	18 39	18 48	18 58	19 10	19 24	19 40	19 59	20 24
	9	18 37	18 41	18 45	18 49	18 54	19 00	19 05	19 12	19 19	19 27	19 36	19 46	19 58	20 12
	10	19 09	19 12	19 14	19 17	19 20	19 23	19 26	19 30	19 34	19 38	19 43	19 49	19 56	20 03
	11	19 38	19 39	19 40	19 41	19 42	19 43	19 44	19 45	19 46	19 48	19 49	19 51	19 53	19 55
	12	20 06	20 05	20 04	20 03	20 02	20 01	20 00	19 59	19 57	19 56	19 54	19 52	19 50	19 48
	13	20 33	20 31	20 28	20 25	20 23	20 20	20 16	20 13	20 09	20 04	19 59	19 54	19 47	19 40
	14	21 01	20 57	20 53	20 49	20 44	20 39	20 34	20 28	20 21	20 14	20 05	19 56	19 44	19 31
	15	21 32	21 27	21 21	21 16	21 09	21 02	20 55	20 46	20 37	20 26	20 14	19 59	19 42	19 21
	16	22 07	22 01	21 54	21 47	21 39	21 30	21 20	21 09	20 57	20 43	20 26	20 06	19 40	19 05
	17	22 47	22 39	22 32	22 23	22 14	22 04	21 53	21 40	21 25	21 07	20 46	20 19	19 40	-- --

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug.	16	8 54	9 17	9 35	9 50	10 03	10 14	10 33	10 50	11 06	11 21	11 38	11 58	12 10	12 23
	17	9 19	9 48	10 10	10 27	10 42	10 55	11 18	11 37	11 55	12 13	12 33	12 56	13 09	13 25
	18	9 53	10 26	10 50	11 10	11 26	11 41	12 05	12 26	12 45	13 05	13 26	13 51	14 05	14 22
	19	10 38	11 13	11 38	11 58	12 15	12 30	12 55	13 16	13 36	13 56	14 17	14 42	14 57	15 14
	20	11 36	12 08	12 33	12 52	13 08	13 22	13 46	14 07	14 26	14 45	15 06	15 29	15 43	15 59
	21	12 42	13 11	13 32	13 50	14 04	14 17	14 38	14 57	15 14	15 32	15 50	16 12	16 24	16 38
	22	13 54	14 17	14 35	14 50	15 02	15 13	15 31	15 47	16 01	16 16	16 32	16 50	17 00	17 12
	23	15 09	15 26	15 40	15 51	16 00	16 08	16 23	16 35	16 47	16 58	17 10	17 24	17 33	17 42
	24	16 24	16 36	16 45	16 52	16 59	17 04	17 14	17 22	17 30	17 38	17 47	17 56	18 02	18 08
	25	17 40	17 45	17 50	17 54	17 57	18 00	18 05	18 09	18 13	18 17	18 22	18 27	18 29	18 33
	26	18 56	18 56	18 56	18 56	18 56	18 56	18 56	18 56	18 56	18 56	18 56	18 56	18 56	18 56
	27	20 13	20 08	20 03	19 59	19 56	19 53	19 48	19 44	19 40	19 36	19 31	19 27	19 24	19 21
	28	21 33	21 21	21 12	21 04	20 58	20 52	20 42	20 33	20 25	20 17	20 08	19 59	19 53	19 47
	29	22 56	22 38	22 23	22 11	22 01	21 53	21 38	21 25	21 13	21 01	20 48	20 34	20 25	20 16
	30	.. ..	23 55	23 36	23 20	23 07	22 56	22 37	22 20	22 04	21 49	21 33	21 14	21 03	20 50
	31	0 20	.. ..	.. ..	.. ..	.. ..	.. ..	23 38	23 18	23 00	22 42	22 22	22 00	21 47	21 32
Sept.	1	1 43	1 12	0 48	0 30	0 14	0 01	.. ..	.. ..	23 59	23 39	23 18	22 53	22 39	22 23
	2	2 57	2 22	1 57	1 36	1 19	1 05	0 40	0 19	.. ..	.. ..	.. ..	23 54	23 40	23 23
	3	3 56	3 22	2 57	2 37	2 20	2 06	1 41	1 20	1 00	0 40	0 19	.. ..	.. ..	.. ..
	4	4 39	4 10	3 48	3 30	3 15	3 02	2 39	2 20	2 01	1 43	1 23	1 01	0 47	0 32
	5	5 09	4 46	4 28	4 14	4 02	3 51	3 32	3 16	3 01	2 45	2 29	2 10	1 59	1 46
	6	5 30	5 14	5 02	4 51	4 42	4 34	4 20	4 08	3 57	3 46	3 33	3 19	3 11	3 02
	7	5 46	5 37	5 30	5 23	5 18	5 13	5 05	4 57	4 50	4 43	4 36	4 27	4 23	4 17
	8	6 00	5 57	5 54	5 52	5 50	5 49	5 46	5 43	5 41	5 39	5 36	5 34	5 32	5 30
	9	6 13	6 15	6 18	6 20	6 21	6 23	6 26	6 28	6 30	6 33	6 35	6 38	6 40	6 41

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug.	16	0 43	0 21	0 04	.. ..	.. ..	.. ..	.. ..	23 46	23 29	23 12	22 54	22 33	22 21	22 07
	17	1 59	1 31	1 10	0 53	0 39	0 26	0 05	.. ..	.. ..	.. ..	23 40	23 16	23 03	22 47
	18	3 08	2 36	2 12	1 53	1 37	1 23	0 59	0 38	0 19	0 00	.. ..	.. ..	23 49	23 32
	19	4 07	3 33	3 08	2 47	2 31	2 16	1 51	1 30	1 10	0 50	0 28	0 04	.. ..	.. ..
	20	4 54	4 21	3 56	3 36	3 20	3 05	2 41	2 20	2 00	1 40	1 19	0 55	0 40	0 23
	21	5 28	4 59	4 36	4 18	4 03	3 50	3 28	3 08	2 50	2 31	2 11	1 48	1 35	1 19
	22	5 53	5 29	5 10	4 55	4 42	4 30	4 11	3 54	3 37	3 21	3 04	2 44	2 32	2 18
	23	6 12	5 53	5 39	5 26	5 16	5 07	4 51	4 37	4 23	4 10	3 56	3 40	3 30	3 19
	24	6 27	6 14	6 03	5 54	5 46	5 40	5 28	5 18	5 08	4 58	4 47	4 35	4 28	4 20
	25	6 39	6 31	6 25	6 19	6 15	6 11	6 03	5 57	5 51	5 45	5 38	5 31	5 27	5 22
	26	6 50	6 47	6 45	6 43	6 42	6 40	6 38	6 36	6 34	6 32	6 29	6 27	6 25	6 24
	27	7 01	7 03	7 05	7 07	7 09	7 10	7 13	7 15	7 17	7 19	7 21	7 23	7 25	7 26
	28	7 12	7 20	7 27	7 32	7 37	7 41	7 48	7 55	8 01	8 07	8 13	8 21	8 25	8 30
	29	7 25	7 39	7 50	8 00	8 07	8 14	8 27	8 37	8 47	8 57	9 08	9 21	9 28	9 36
	30	7 42	8 02	8 18	8 31	8 42	8 52	9 09	9 23	9 37	9 51	10 06	10 23	10 33	10 44
	31	8 06	8 32	8 52	9 08	9 22	9 35	9 55	10 13	10 30	10 47	11 06	11 27	11 39	11 53
Sept.	1	8 39	9 11	9 35	9 54	10 10	10 24	10 48	11 08	11 28	11 47	12 08	12 31	12 45	13 02
	2	9 29	10 03	10 29	10 50	11 07	11 21	11 46	12 08	12 28	12 48	13 09	13 34	13 49	14 06
	3	10 37	11 10	11 35	11 54	12 11	12 25	12 49	13 10	13 29	13 49	14 09	14 33	14 47	15 03
	4	12 00	12 28	12 49	13 07	13 21	13 33	13 55	14 13	14 30	14 47	15 05	15 25	15 37	15 51
	5	13 31	13 52	14 09	14 22	14 33	14 43	15 00	15 14	15 28	15 41	15 55	16 12	16 21	16 31
	6	15 04	15 18	15 29	15 38	15 45	15 52	16 04	16 13	16 23	16 32	16 42	16 53	16 59	17 06
	7	16 35	16 42	16 48	16 52	16 56	16 59	17 05	17 10	17 15	17 19	17 24	17 30	17 33	17 36
	8	18 04	18 04	18 04	18 04	18 04	18 04	18 05	18 05	18 05	18 05	18 05	18 05	18 04	18 04
	9	19 30	19 24	19 19	19 15	19 11	19 08	19 03	18 58	18 53	18 49	18 44	18 39	18 35	18 32

(.. ..) indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug. 16	12 23	12 29	12 35	12 42	12 50	12 58	13 07	13 18	13 30	13 43	14 00	14 19	14 44	15 19
17	13 25	13 32	13 39	13 47	13 56	14 06	14 17	14 30	14 44	15 02	15 23	15 49	16 28	-- --
18	14 22	14 30	14 38	14 47	14 56	15 07	15 20	15 34	15 50	16 09	16 34	17 07	18 04	-- --
19	15 14	15 21	15 30	15 39	15 49	16 00	16 12	16 26	16 43	17 02	17 27	18 00	18 59	-- --
20	15 59	16 06	16 14	16 23	16 32	16 42	16 54	17 07	17 22	17 40	18 01	18 29	19 09	-- --
21	16 38	16 45	16 52	16 59	17 07	17 16	17 26	17 37	17 50	18 04	18 22	18 43	19 10	19 48
22	17 12	17 18	17 23	17 29	17 36	17 43	17 51	18 00	18 10	18 21	18 34	18 50	19 08	19 31
23	17 42	17 46	17 50	17 55	18 00	18 05	18 11	18 18	18 25	18 33	18 43	18 53	19 06	19 21
24	18 08	18 11	18 14	18 17	18 20	18 24	18 28	18 32	18 37	18 42	18 48	18 55	19 03	19 12
25	18 33	18 34	18 36	18 37	18 39	18 41	18 43	18 45	18 47	18 50	18 53	18 56	19 00	19 05
26	18 56	18 56	18 57	18 57	18 57	18 57	18 57	18 57	18 57	18 57	18 57	18 57	18 57	18 57
27	19 21	19 19	19 18	19 16	19 15	19 13	19 11	19 09	19 07	19 04	19 01	18 58	18 54	18 50
28	19 47	19 44	19 41	19 38	19 35	19 31	19 27	19 23	19 18	19 12	19 06	19 00	18 52	18 43
29	20 16	20 12	20 07	20 03	19 58	19 52	19 46	19 39	19 32	19 23	19 14	19 03	18 50	18 35
30	20 50	20 45	20 39	20 33	20 26	20 18	20 10	20 00	19 50	19 38	19 24	19 08	18 49	18 24
31	21 32	21 25	21 18	21 10	21 02	20 52	20 42	20 30	20 17	20 01	19 43	19 20	18 50	18 05
Sept. 1	22 23	22 15	22 07	21 58	21 49	21 38	21 26	21 12	20 57	20 38	20 15	19 45	19 00	** **
2	23 23	23 15	23 07	22 58	22 48	22 38	22 25	22 11	21 55	21 36	21 12	20 40	19 47	** **
3	.. ..	.. ..	.. ..	.. ..	.. ..	23 51	23 40	23 27	23 13	22 56	22 35	22 09	21 32	20 13
4	0 32	0 25	0 17	0 09	0 00	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 56	23 33	23 03
5	1 46	1 40	1 34	1 28	1 20	1 12	1 04	0 54	0 42	0 30	0 14	.. ..	.. ..	.. ..
6	3 02	2 58	2 53	2 49	2 43	2 38	2 31	2 24	2 17	2 08	1 58	1 46	1 32	1 15
7	4 17	4 14	4 12	4 09	4 06	4 03	3 59	3 55	3 50	3 45	3 40	3 33	3 26	3 17
8	5 30	5 29	5 28	5 28	5 27	5 25	5 24	5 23	5 22	5 20	5 18	5 16	5 14	5 11
9	6 41	6 42	6 43	6 44	6 45	6 46	6 48	6 49	6 50	6 52	6 54	6 56	6 59	7 01

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug. 16	22 07	22 01	21 54	21 47	21 39	21 30	21 20	21 09	20 57	20 43	20 26	20 06	19 40	19 05
17	22 47	22 39	22 32	22 23	22 14	22 04	21 53	21 40	21 25	21 07	20 46	20 19	19 40	-- --
18	23 32	23 25	23 16	23 07	22 57	22 46	22 34	22 20	22 04	21 44	21 19	20 46	19 49	-- --
19	.. ..	.. ..	.. ..	23 59	23 49	23 38	23 26	23 11	22 55	22 35	22 11	21 37	20 39	-- --
20	0 23	0 16	0 08	.. ..	.. ..	.. ..	.. ..	.. ..	23 58	23 41	23 20	22 52	22 12	-- --
21	1 19	1 12	1 05	0 56	0 47	0 37	0 26	0 13	.. ..	.. ..	.. ..	.. ..	23 52	23 14
22	2 18	2 12	2 06	1 58	1 51	1 42	1 33	1 22	1 10	0 55	0 39	0 18	.. ..	.. ..
23	3 19	3 14	3 09	3 03	2 57	2 50	2 43	2 34	2 25	2 14	2 02	1 47	1 29	1 07
24	4 20	4 17	4 13	4 09	4 04	3 59	3 54	3 48	3 41	3 34	3 26	3 16	3 04	2 51
25	5 22	5 20	5 17	5 15	5 12	5 09	5 06	5 02	4 58	4 54	4 49	4 43	4 37	4 29
26	6 24	6 23	6 22	6 21	6 20	6 19	6 18	6 17	6 15	6 14	6 12	6 10	6 08	6 05
27	7 26	7 27	7 28	7 28	7 29	7 30	7 31	7 32	7 33	7 35	7 36	7 38	7 40	7 42
28	8 30	8 32	8 35	8 37	8 40	8 43	8 46	8 49	8 53	8 58	9 02	9 08	9 14	9 22
29	9 36	9 40	9 44	9 48	9 52	9 57	10 03	10 09	10 16	10 23	10 32	10 42	10 54	11 08
30	10 44	10 49	10 55	11 01	11 07	11 14	11 22	11 31	11 41	11 52	12 05	12 20	12 39	13 03
31	11 53	12 00	12 07	12 14	12 22	12 31	12 42	12 53	13 06	13 21	13 39	14 01	14 31	15 15
Sept. 1	13 02	13 09	13 17	13 26	13 35	13 46	13 57	14 11	14 26	14 45	15 07	15 37	16 22	** **
2	14 06	14 13	14 22	14 31	14 40	14 51	15 04	15 18	15 34	15 53	16 17	16 50	17 43	** **
3	15 03	15 10	15 17	15 26	15 35	15 45	15 56	16 09	16 24	16 41	17 02	17 29	18 06	19 26
4	15 51	15 57	16 04	16 11	16 18	16 27	16 36	16 47	16 58	17 12	17 28	17 47	18 10	18 42
5	16 31	16 36	16 41	16 47	16 52	16 59	17 06	17 13	17 22	17 31	17 42	17 55	18 10	18 28
6	17 06	17 09	17 12	17 16	17 20	17 24	17 28	17 33	17 39	17 45	17 52	18 00	18 09	18 19
7	17 36	17 38	17 39	17 41	17 43	17 45	17 47	17 50	17 52	17 55	17 59	18 02	18 06	18 11
8	18 04	18 04	18 04	18 04	18 04	18 04	18 04	18 04	18 04	18 04	18 04	18 04	18 04	18 04
9	18 32	18 30	18 29	18 27	18 25	18 23	18 21	18 18	18 16	18 13	18 09	18 06	18 01	17 57

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Sept.	8	6 00	5 57	5 54	5 52	5 50	5 49	5 46	5 43	5 41	5 39	5 36	5 34	5 32	5 30
	9	6 13	6 15	6 18	6 20	6 21	6 23	6 26	6 28	6 30	6 33	6 35	6 38	6 40	6 41
	10	6 26	6 34	6 41	6 47	6 52	6 57	7 05	7 12	7 19	7 25	7 33	7 41	7 46	7 51
	11	6 40	6 55	7 07	7 16	7 25	7 32	7 45	7 56	8 07	8 18	8 30	8 43	8 51	9 00
	12	6 58	7 19	7 35	7 48	8 00	8 10	8 27	8 42	8 56	9 11	9 26	9 44	9 54	10 06
	13	7 21	7 47	8 08	8 24	8 38	8 50	9 11	9 29	9 47	10 04	10 22	10 44	10 56	11 11
	14	7 52	8 23	8 46	9 05	9 21	9 35	9 58	10 18	10 37	10 57	11 17	11 41	11 55	12 11
	15	8 33	9 07	9 32	9 52	10 09	10 23	10 48	11 09	11 29	11 48	12 10	12 34	12 49	13 06
	16	9 26	9 59	10 24	10 44	11 00	11 15	11 39	12 00	12 19	12 38	12 59	13 23	13 38	13 54
	17	10 29	10 59	11 22	11 40	11 55	12 08	12 31	12 50	13 08	13 26	13 45	14 08	14 21	14 36
	18	11 39	12 04	12 23	12 39	12 52	13 04	13 23	13 40	13 56	14 11	14 28	14 47	14 59	15 11
	19	12 53	13 12	13 27	13 40	13 50	13 59	14 15	14 29	14 41	14 54	15 08	15 23	15 32	15 42
	20	14 08	14 21	14 32	14 41	14 48	14 55	15 06	15 16	15 26	15 35	15 45	15 56	16 03	16 10
	21	15 23	15 31	15 37	15 42	15 47	15 51	15 58	16 03	16 09	16 15	16 21	16 27	16 31	16 35
	22	16 39	16 41	16 43	16 45	16 46	16 47	16 49	16 51	16 52	16 54	16 55	16 57	16 59	17 00
	23	17 57	17 54	17 51	17 48	17 46	17 44	17 41	17 39	17 36	17 34	17 31	17 28	17 26	17 24
	24	19 17	19 08	19 00	18 54	18 48	18 43	18 35	18 28	18 21	18 15	18 08	18 00	17 55	17 50
	25	20 40	20 24	20 12	20 01	19 52	19 45	19 32	19 20	19 09	18 59	18 48	18 35	18 27	18 19
	26	22 05	21 43	21 25	21 11	20 59	20 48	20 31	20 15	20 01	19 46	19 31	19 14	19 04	18 52
	27	23 29	23 00	22 39	22 21	22 06	21 53	21 32	21 13	20 56	20 38	20 20	19 59	19 46	19 32
	28	.. ..	.. ..	23 49	23 29	23 12	22 58	22 34	22 13	21 54	21 35	21 14	20 50	20 36	20 20
	29	0 47	0 13	.. ..	.. ..	.. ..	.. ..	23 35	23 14	22 54	22 34	22 13	21 49	21 34	21 17
	30	1 50	1 16	0 51	0 31	0 14	0 00	.. ..	.. ..	23 54	23 36	23 16	22 52	22 39	22 23
Oct.	1	2 37	2 07	1 44	1 25	1 10	0 56	0 33	0 13	.. ..	.. ..	.. ..	23 59	23 47	23 34
	2	3 10	2 46	2 27	2 11	1 58	1 46	1 27	1 09	0 53	0 37	0 19	.. ..	.. ..	.. ..

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Sept.	8	18 04	18 04	18 04	18 04	18 04	18 04	18 05	18 05	18 05	18 05	18 05	18 05	18 04	18 04
	9	19 30	19 24	19 19	19 15	19 11	19 08	19 03	18 58	18 53	18 49	18 44	18 39	18 35	18 32
	10	20 55	20 42	20 32	20 24	20 17	20 11	20 00	19 51	19 42	19 33	19 24	19 13	19 07	19 00
	11	22 18	21 59	21 44	21 32	21 21	21 12	20 57	20 43	20 31	20 18	20 05	19 49	19 41	19 30
	12	23 38	23 13	22 53	22 38	22 24	22 13	21 53	21 36	21 20	21 05	20 48	20 28	20 17	20 04
	13	.. ..	.. ..	23 58	23 40	23 25	23 11	22 49	22 29	22 11	21 53	21 33	21 11	20 58	20 43
	14	0 52	0 21	.. ..	.. ..	.. ..	.. ..	23 43	23 22	23 02	22 43	22 22	21 57	21 43	21 27
	15	1 56	1 22	0 58	0 38	0 21	0 07	.. ..	.. ..	23 53	23 33	23 12	22 47	22 33	22 16
	16	2 47	2 14	1 49	1 29	1 13	0 58	0 34	0 13	.. ..	.. ..	.. ..	23 40	23 26	23 10
	17	3 27	2 56	2 33	2 14	1 59	1 45	1 22	1 02	0 43	0 24	0 04	.. ..	.. ..	.. ..
	18	3 55	3 29	3 09	2 53	2 39	2 27	2 06	1 48	1 31	1 14	0 56	0 35	0 22	0 08
	19	4 17	3 56	3 40	3 26	3 15	3 05	2 47	2 32	2 18	2 04	1 48	1 30	1 20	1 08
	20	4 33	4 18	4 06	3 55	3 47	3 39	3 26	3 14	3 03	2 52	2 40	2 26	2 18	2 09
	21	4 46	4 36	4 28	4 22	4 16	4 11	4 02	3 54	3 47	3 39	3 31	3 22	3 16	3 10
	22	4 58	4 53	4 50	4 46	4 44	4 41	4 37	4 33	4 30	4 26	4 22	4 18	4 15	4 12
	23	5 09	5 10	5 10	5 11	5 11	5 11	5 12	5 13	5 13	5 13	5 14	5 14	5 15	5 15
	24	5 21	5 27	5 32	5 36	5 39	5 43	5 48	5 53	5 57	6 02	6 07	6 12	6 16	6 19
	25	5 34	5 46	5 55	6 03	6 10	6 16	6 26	6 35	6 44	6 53	7 02	7 13	7 19	7 26
	26	5 50	6 08	6 22	6 34	6 44	6 52	7 08	7 21	7 33	7 46	7 59	8 15	8 24	8 34
	27	6 12	6 36	6 55	7 10	7 23	7 34	7 54	8 11	8 26	8 42	9 00	9 19	9 31	9 44
	28	6 43	7 12	7 35	7 53	8 09	8 22	8 45	9 05	9 23	9 42	10 01	10 24	10 38	10 54
	29	7 27	8 01	8 26	8 46	9 03	9 17	9 42	10 03	10 22	10 42	11 03	11 28	11 42	11 59
	30	8 29	9 02	9 27	9 47	10 04	10 18	10 43	11 03	11 23	11 42	12 03	12 27	12 41	12 57
Oct.	1	9 46	10 16	10 38	10 56	11 11	11 24	11 46	12 05	12 23	12 40	12 59	13 20	13 33	13 47
	2	11 13	11 36	11 54	12 08	12 21	12 31	12 50	13 05	13 20	13 34	13 50	14 08	14 18	14 29

(.. ..) indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Sept. 8	5 30	5 29	5 28	5 28	5 27	5 25	5 24	5 23	5 22	5 20	5 18	5 16	5 14	5 11
9	6 41	6 42	6 43	6 44	6 45	6 46	6 48	6 49	6 50	6 52	6 54	6 56	6 59	7 01
10	7 51	7 54	7 56	7 59	8 02	8 05	8 09	8 13	8 17	8 22	8 28	8 34	8 42	8 50
11	9 00	9 04	9 08	9 12	9 17	9 23	9 29	9 35	9 43	9 51	10 01	10 12	10 25	10 41
12	10 06	10 12	10 18	10 24	10 31	10 38	10 46	10 56	11 06	11 18	11 32	11 48	12 09	12 35
13	11 11	11 17	11 24	11 32	11 40	11 49	12 00	12 11	12 25	12 40	12 59	13 22	13 53	14 43
14	12 11	12 18	12 26	12 35	12 44	12 55	13 06	13 20	13 35	13 54	14 17	14 47	15 33	-- --
15	13 06	13 13	13 21	13 30	13 40	13 51	14 03	14 18	14 34	14 53	15 18	15 51	16 48	-- --
16	13 54	14 01	14 09	14 18	14 27	14 38	14 50	15 03	15 19	15 37	15 59	16 29	17 14	-- --
17	14 36	14 42	14 49	14 57	15 06	15 15	15 26	15 37	15 51	16 06	16 25	16 48	17 19	18 06
18	15 11	15 17	15 23	15 30	15 37	15 45	15 53	16 03	16 14	16 26	16 41	16 58	17 19	17 46
19	15 42	15 47	15 52	15 57	16 03	16 09	16 15	16 23	16 31	16 40	16 51	17 03	17 18	17 35
20	16 10	16 13	16 17	16 20	16 24	16 29	16 33	16 39	16 44	16 51	16 58	17 06	17 16	17 27
21	16 35	16 37	16 39	16 42	16 44	16 46	16 49	16 52	16 55	16 59	17 03	17 08	17 13	17 19
22	17 00	17 00	17 01	17 02	17 02	17 03	17 04	17 05	17 06	17 07	17 08	17 09	17 11	17 12
23	17 24	17 24	17 23	17 22	17 21	17 20	17 18	17 17	17 16	17 14	17 12	17 11	17 08	17 06
24	17 50	17 48	17 46	17 43	17 40	17 37	17 34	17 31	17 27	17 23	17 18	17 12	17 06	16 59
25	18 19	18 15	18 12	18 07	18 03	17 58	17 53	17 47	17 40	17 33	17 25	17 15	17 04	16 52
26	18 52	18 47	18 42	18 36	18 30	18 23	18 15	18 07	17 58	17 47	17 35	17 21	17 04	16 43
27	19 32	19 26	19 19	19 12	19 04	18 55	18 45	18 35	18 22	18 08	17 51	17 31	17 05	16 30
28	20 20	20 13	20 05	19 57	19 48	19 37	19 26	19 13	18 58	18 41	18 19	17 52	17 14	** **
29	21 17	21 10	21 02	20 53	20 43	20 33	20 20	20 07	19 51	19 32	19 08	18 37	17 47	** **
30	22 23	22 16	22 08	22 00	21 51	21 40	21 29	21 16	21 01	20 44	20 22	19 55	19 15	** **
Oct. 1	23 34	23 28	23 21	23 14	23 06	22 58	22 48	22 38	22 25	22 11	21 55	21 34	21 08	20 32
2	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 56	23 46	23 34	23 20	23 04	22 43

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Sept. 8	18 04	18 04	18 04	18 04	18 04	18 04	18 04	18 04	18 04	18 04	18 04	18 04	18 04	18 04
9	18 32	18 30	18 29	18 27	18 25	18 23	18 21	18 18	18 16	18 13	18 09	18 06	18 01	17 57
10	19 00	18 57	18 54	18 50	18 47	18 43	18 38	18 33	18 28	18 22	18 15	18 08	17 59	17 49
11	19 30	19 26	19 21	19 16	19 11	19 05	18 58	18 51	18 43	18 33	18 23	18 11	17 57	17 40
12	20 04	19 59	19 52	19 46	19 39	19 31	19 22	19 12	19 01	18 49	18 34	18 17	17 56	17 28
13	20 43	20 36	20 29	20 21	20 12	20 03	19 52	19 40	19 26	19 10	18 51	18 28	17 56	17 06
14	21 27	21 19	21 11	21 02	20 53	20 42	20 30	20 17	20 01	19 42	19 20	18 49	18 03	-- --
15	22 16	22 08	22 00	21 51	21 41	21 31	21 18	21 04	20 48	20 28	20 04	19 31	18 34	-- --
16	23 10	23 03	22 55	22 47	22 37	22 27	22 15	22 02	21 47	21 29	21 06	20 37	19 53	-- --
17	.. ..	.. ..	23 55	23 47	23 39	23 30	23 20	23 08	22 55	22 40	22 22	21 59	21 29	20 42
18	0 08	0 02	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 57	23 43	23 26	23 06	22 40
19	1 08	1 03	0 57	0 51	0 44	0 37	0 28	0 19	0 09	.. ..	.. ..	.. ..	.. ..	.. ..
20	2 09	2 05	2 00	1 56	1 51	1 45	1 39	1 32	1 25	1 16	1 06	0 55	0 41	0 25
21	3 10	3 08	3 05	3 02	2 58	2 55	2 50	2 46	2 41	2 36	2 29	2 22	2 14	2 04
22	4 12	4 11	4 09	4 08	4 06	4 05	4 03	4 01	3 58	3 56	3 53	3 49	3 46	3 41
23	5 15	5 15	5 15	5 15	5 16	5 16	5 16	5 16	5 16	5 17	5 17	5 17	5 18	5 18
24	6 19	6 21	6 23	6 25	6 27	6 29	6 31	6 34	6 37	6 40	6 43	6 47	6 52	6 58
25	7 26	7 29	7 32	7 36	7 40	7 44	7 49	7 54	7 59	8 06	8 13	8 21	8 31	8 42
26	8 34	8 39	8 44	8 49	8 55	9 01	9 08	9 16	9 25	9 35	9 46	9 59	10 15	10 35
27	9 44	9 50	9 57	10 04	10 11	10 20	10 29	10 39	10 51	11 05	11 21	11 41	12 06	12 40
28	10 54	11 01	11 08	11 16	11 25	11 35	11 47	11 59	12 14	12 31	12 52	13 19	13 57	** **
29	11 59	12 06	12 15	12 23	12 33	12 44	12 56	13 10	13 26	13 45	14 08	14 39	15 29	** **
30	12 57	13 05	13 12	13 21	13 30	13 41	13 52	14 05	14 21	14 38	15 00	15 28	16 08	** **
Oct. 1	13 47	13 54	14 01	14 08	14 16	14 25	14 35	14 46	14 59	15 13	15 31	15 52	16 18	16 56
2	14 29	14 34	14 40	14 46	14 52	14 59	15 07	15 16	15 25	15 36	15 48	16 03	16 20	16 42

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	1	2 37	2 07	1 44	1 25	1 10	0 56	0 33	0 13	.. ..	.. ..	.. ..	23 59	23 47	23 34
	2	3 10	2 46	2 27	2 11	1 58	1 46	1 27	1 09	0 53	0 37	0 19	.. ..	.. ..	.. ..
	3	3 34	3 16	3 01	2 50	2 39	2 30	2 15	2 02	1 49	1 36	1 22	1 07	0 57	0 47
	4	3 51	3 40	3 30	3 22	3 16	3 10	2 59	2 50	2 42	2 33	2 24	2 13	2 07	2 00
	5	4 06	4 00	3 56	3 52	3 49	3 46	3 41	3 36	3 32	3 28	3 23	3 18	3 15	3 12
	6	4 19	4 19	4 19	4 19	4 20	4 20	4 20	4 20	4 20	4 21	4 21	4 21	4 22	4 22
	7	4 32	4 38	4 43	4 47	4 50	4 53	4 59	5 04	5 08	5 13	5 18	5 24	5 27	5 31
	8	4 46	4 58	5 07	5 15	5 22	5 28	5 39	5 48	5 57	6 06	6 15	6 26	6 33	6 40
	9	5 03	5 20	5 34	5 46	5 56	6 05	6 20	6 33	6 46	6 59	7 12	7 28	7 37	7 48
	10	5 24	5 47	6 05	6 20	6 33	6 44	7 04	7 20	7 36	7 52	8 09	8 29	8 40	8 54
	11	5 52	6 20	6 42	7 00	7 15	7 28	7 50	8 09	8 27	8 46	9 05	9 28	9 41	9 57
	12	6 29	7 01	7 25	7 45	8 01	8 15	8 39	9 00	9 19	9 39	9 59	10 24	10 38	10 54
	13	7 18	7 51	8 15	8 35	8 52	9 06	9 30	9 51	10 10	10 30	10 51	11 15	11 29	11 46
	14	8 17	8 48	9 11	9 30	9 46	9 59	10 22	10 42	11 00	11 19	11 39	12 01	12 15	12 30
	15	9 24	9 51	10 11	10 28	10 42	10 54	11 14	11 32	11 49	12 05	12 23	12 43	12 55	13 08
	16	10 36	10 57	11 14	11 27	11 39	11 49	12 06	12 21	12 35	12 49	13 03	13 20	13 30	13 41
	17	11 49	12 05	12 17	12 28	12 36	12 44	12 57	13 08	13 19	13 30	13 41	13 54	14 01	14 10
	18	13 04	13 14	13 22	13 28	13 34	13 39	13 48	13 55	14 02	14 10	14 17	14 26	14 30	14 36
	19	14 19	14 23	14 27	14 30	14 32	14 35	14 39	14 42	14 45	14 49	14 52	14 56	14 58	15 01
	20	15 35	15 34	15 33	15 33	15 32	15 31	15 30	15 29	15 29	15 28	15 27	15 26	15 26	15 25
	21	16 55	16 48	16 42	16 37	16 33	16 30	16 24	16 19	16 14	16 09	16 04	15 58	15 55	15 51
	22	18 17	18 04	17 54	17 45	17 37	17 31	17 20	17 10	17 01	16 52	16 43	16 32	16 26	16 19
	23	19 43	19 23	19 08	18 55	18 44	18 35	18 19	18 05	17 52	17 39	17 26	17 10	17 01	16 51
	24	21 10	20 43	20 23	20 07	19 53	19 41	19 21	19 03	18 47	18 31	18 14	17 54	17 43	17 29
	25	22 32	22 00	21 37	21 18	21 02	20 48	20 25	20 05	19 46	19 27	19 07	18 45	18 31	18 16

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	1	9 46	10 16	10 38	10 56	11 11	11 24	11 46	12 05	12 23	12 40	12 59	13 20	13 33	13 47
	2	11 13	11 36	11 54	12 08	12 21	12 31	12 50	13 05	13 20	13 34	13 50	14 08	14 18	14 29
	3	12 42	12 59	13 11	13 22	13 31	13 38	13 52	14 03	14 14	14 25	14 36	14 49	14 56	15 05
	4	14 11	14 21	14 28	14 34	14 40	14 44	14 52	14 59	15 06	15 12	15 19	15 27	15 31	15 36
	5	15 38	15 41	15 43	15 45	15 47	15 48	15 51	15 53	15 55	15 57	15 59	16 01	16 03	16 04
	6	17 04	17 00	16 57	16 55	16 53	16 51	16 48	16 46	16 43	16 41	16 38	16 35	16 33	16 31
	7	18 28	18 18	18 11	18 04	17 59	17 54	17 45	17 38	17 31	17 25	17 17	17 09	17 04	16 59
	8	19 51	19 35	19 23	19 12	19 04	18 56	18 43	18 31	18 20	18 09	17 58	17 45	17 37	17 29
	9	21 13	20 51	20 34	20 20	20 08	19 57	19 40	19 24	19 10	18 55	18 40	18 23	18 13	18 01
	10	22 30	22 02	21 41	21 24	21 10	20 57	20 36	20 18	20 01	19 44	19 25	19 04	18 52	18 38
	11	23 40	23 08	22 44	22 25	22 09	21 55	21 32	21 11	20 52	20 33	20 13	19 50	19 36	19 20
	12	.. ..	.. ..	23 39	23 20	23 03	22 49	22 25	22 04	21 44	21 24	21 03	20 39	20 25	20 08
	13	0 37	0 04	.. ..	.. ..	23 52	23 38	23 14	22 54	22 35	22 16	21 55	21 31	21 17	21 01
	14	1 22	0 50	0 27	0 08	.. ..	.. ..	.. ..	23 41	23 24	23 06	22 47	22 25	22 12	21 57
	15	1 54	1 27	1 06	0 49	0 34	0 22	0 00	.. ..	.. ..	23 56	23 39	23 20	23 09	22 56
	16	2 19	1 56	1 39	1 24	1 12	1 01	0 43	0 26	0 11	.. ..	.. ..	.. ..	.. ..	23 56
	17	2 37	2 20	2 06	1 55	1 45	1 36	1 22	1 09	0 56	0 44	0 31	0 15	0 07	.. ..
	18	2 52	2 40	2 30	2 22	2 15	2 09	1 58	1 49	1 40	1 31	1 22	1 11	1 04	0 57
	19	3 04	2 57	2 52	2 47	2 43	2 40	2 34	2 28	2 23	2 18	2 12	2 06	2 02	1 58
	20	3 16	3 14	3 13	3 12	3 11	3 10	3 09	3 07	3 06	3 05	3 03	3 02	3 01	3 00
	21	3 27	3 31	3 34	3 37	3 39	3 41	3 44	3 47	3 50	3 53	3 56	3 59	4 01	4 03
	22	3 40	3 49	3 57	4 03	4 08	4 13	4 22	4 29	4 36	4 43	4 50	4 59	5 04	5 09
	23	3 55	4 11	4 23	4 33	4 41	4 49	5 02	5 14	5 25	5 36	5 48	6 01	6 09	6 18
	24	4 16	4 37	4 54	5 08	5 19	5 30	5 48	6 03	6 18	6 33	6 48	7 06	7 17	7 29
	25	4 44	5 11	5 33	5 50	6 04	6 17	6 38	6 57	7 15	7 32	7 51	8 13	8 26	8 41

(.. ..) indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	1	23 34	23 28	23 21	23 14	23 06	22 58	22 48	22 38	22 25	22 11	21 55	21 34	21 08	20 32
	2	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 56	23 46	23 34	23 20	23 04	22 43
	3	0 47	0 42	0 37	0 32	0 26	0 19	0 12	0 04	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
	4	2 00	1 57	1 53	1 50	1 46	1 42	1 37	1 32	1 26	1 20	1 13	1 05	0 55	0 44
	5	3 12	3 10	3 09	3 07	3 05	3 03	3 01	2 58	2 56	2 53	2 49	2 46	2 41	2 36
	6	4 22	4 22	4 22	4 22	4 22	4 23	4 23	4 23	4 23	4 23	4 24	4 24	4 24	4 25
	7	5 31	5 33	5 35	5 37	5 39	5 41	5 44	5 46	5 49	5 53	5 57	6 01	6 06	6 12
	8	6 40	6 43	6 47	6 50	6 54	6 59	7 04	7 09	7 15	7 22	7 29	7 38	7 48	8 00
	9	7 48	7 52	7 57	8 03	8 09	8 15	8 22	8 30	8 39	8 49	9 01	9 15	9 31	9 52
	10	8 54	9 00	9 06	9 13	9 21	9 29	9 38	9 49	10 01	10 14	10 31	10 50	11 16	11 51
	11	9 57	10 03	10 11	10 19	10 28	10 38	10 49	11 01	11 16	11 33	11 54	12 20	12 57	-- --
	12	10 54	11 02	11 10	11 19	11 28	11 39	11 51	12 05	12 20	12 39	13 03	13 34	14 24	-- --
	13	11 46	11 53	12 01	12 10	12 19	12 30	12 42	12 56	13 11	13 30	13 53	14 23	15 10	-- --
	14	12 30	12 37	12 45	12 53	13 01	13 11	13 22	13 34	13 49	14 05	14 25	14 50	15 24	16 24
	15	13 08	13 14	13 21	13 28	13 35	13 44	13 53	14 03	14 15	14 29	14 44	15 03	15 27	15 59
	16	13 41	13 46	13 51	13 57	14 03	14 10	14 17	14 25	14 35	14 45	14 57	15 11	15 27	15 48
	17	14 10	14 14	14 18	14 22	14 26	14 31	14 37	14 43	14 49	14 57	15 05	15 15	15 26	15 39
	18	14 36	14 38	14 41	14 44	14 47	14 50	14 54	14 57	15 02	15 06	15 12	15 18	15 24	15 32
	19	15 01	15 02	15 03	15 04	15 06	15 07	15 09	15 10	15 12	15 14	15 17	15 20	15 23	15 26
	20	15 25	15 25	15 25	15 24	15 24	15 24	15 23	15 23	15 23	15 22	15 22	15 21	15 21	15 20
	21	15 51	15 49	15 47	15 46	15 44	15 41	15 39	15 37	15 34	15 31	15 27	15 23	15 19	15 14
	22	16 19	16 16	16 13	16 09	16 05	16 01	15 57	15 52	15 47	15 41	15 34	15 26	15 17	15 07
	23	16 51	16 47	16 42	16 37	16 31	16 25	16 18	16 11	16 03	15 54	15 43	15 31	15 17	15 00
	24	17 29	17 24	17 17	17 11	17 03	16 55	16 46	16 37	16 25	16 13	15 58	15 40	15 19	14 51
	25	18 16	18 09	18 02	17 54	17 45	17 35	17 24	17 12	16 58	16 42	16 22	15 58	15 26	14 33

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	1	13 47	13 54	14 01	14 08	14 16	14 25	14 35	14 46	14 59	15 13	15 31	15 52	16 18	16 56
	2	14 29	14 34	14 40	14 46	14 52	14 59	15 07	15 16	15 25	15 36	15 48	16 03	16 20	16 42
	3	15 05	15 09	15 12	15 17	15 21	15 26	15 32	15 37	15 44	15 51	16 00	16 09	16 20	16 33
	4	15 36	15 38	15 40	15 43	15 45	15 48	15 51	15 55	15 59	16 03	16 07	16 13	16 19	16 25
	5	16 04	16 05	16 06	16 06	16 07	16 08	16 09	16 10	16 11	16 12	16 13	16 15	16 17	16 19
	6	16 31	16 31	16 30	16 29	16 28	16 27	16 25	16 24	16 22	16 21	16 19	16 17	16 15	16 12
	7	16 59	16 57	16 54	16 52	16 49	16 46	16 42	16 39	16 35	16 30	16 25	16 19	16 13	16 05
	8	17 29	17 25	17 21	17 16	17 12	17 07	17 01	16 55	16 48	16 41	16 32	16 22	16 11	15 58
	9	18 01	17 56	17 51	17 45	17 38	17 31	17 24	17 15	17 05	16 55	16 42	16 28	16 10	15 49
	10	18 38	18 32	18 25	18 18	18 10	18 01	17 51	17 40	17 28	17 14	16 57	16 37	16 11	15 35
	11	19 20	19 13	19 05	18 57	18 48	18 38	18 27	18 14	17 59	17 42	17 21	16 54	16 16	-- --
	12	20 08	20 01	19 52	19 44	19 34	19 23	19 11	18 57	18 41	18 22	17 59	17 28	16 37	-- --
	13	21 01	20 54	20 46	20 37	20 27	20 17	20 05	19 52	19 36	19 18	18 55	18 25	17 38	-- --
	14	21 57	21 51	21 43	21 36	21 27	21 17	21 07	20 55	20 41	20 25	20 05	19 41	19 07	18 07
	15	22 56	22 51	22 44	22 38	22 30	22 22	22 14	22 04	21 52	21 39	21 24	21 06	20 42	20 11
	16	23 56	23 52	23 47	23 42	23 36	23 30	23 23	23 15	23 07	22 57	22 46	22 32	22 17	21 57
	17	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 59	23 49	23 37
	18	0 57	0 54	0 50	0 46	0 42	0 38	0 33	0 28	0 22	0 15	0 08	.. ..	.. ..	.. ..
	19	1 58	1 56	1 54	1 52	1 49	1 47	1 44	1 41	1 38	1 34	1 30	1 25	1 19	1 13
	20	3 00	2 59	2 59	2 58	2 58	2 57	2 56	2 56	2 55	2 54	2 53	2 52	2 50	2 49
	21	4 03	4 04	4 05	4 07	4 08	4 09	4 11	4 12	4 14	4 16	4 18	4 20	4 23	4 27
	22	5 09	5 12	5 14	5 17	5 20	5 24	5 27	5 31	5 36	5 41	5 46	5 53	6 00	6 09
	23	6 18	6 22	6 26	6 31	6 36	6 41	6 47	6 54	7 01	7 10	7 19	7 30	7 44	7 59
	24	7 29	7 35	7 40	7 47	7 54	8 01	8 10	8 19	8 29	8 42	8 56	9 13	9 33	10 00
	25	8 41	8 47	8 54	9 02	9 11	9 20	9 31	9 42	9 56	10 12	10 31	10 55	11 27	12 19

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	24	21 10	20 43	20 23	20 07	19 53	19 41	19 21	19 03	18 47	18 31	18 14	17 54	17 43	17 29
	25	22 32	22 00	21 37	21 18	21 02	20 48	20 25	20 05	19 46	19 27	19 07	18 45	18 31	18 16
	26	23 42	23 08	22 43	22 23	22 07	21 52	21 28	21 07	20 47	20 27	20 06	19 42	19 28	19 11
	27	.. ..	.. ..	23 40	23 21	23 05	22 51	22 28	22 08	21 49	21 30	21 09	20 46	20 32	20 16
	28	0 35	0 04	.. ..	.. ..	23 56	23 44	23 23	23 05	22 48	22 31	22 13	21 52	21 40	21 26
	29	1 12	0 46	0 26	0 10	.. ..	.. ..	.. ..	.. ..	23 58	23 45	23 31	23 16	23 00	22 50	22 38
	30	1 38	1 18	1 03	0 50	0 39	0 30	0 13	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 59	23 51
	31	1 57	1 44	1 33	1 24	1 17	1 10	0 58	0 48	0 38	0 28	0 18	0 06	.. ..	.. ..
Nov.	1	2 12	2 05	1 59	1 54	1 50	1 46	1 39	1 33	1 28	1 22	1 16	1 10	1 06	1 01
	2	2 26	2 24	2 23	2 22	2 21	2 20	2 18	2 17	2 16	2 15	2 13	2 12	2 11	2 10
	3	2 38	2 42	2 46	2 48	2 51	2 53	2 56	3 00	3 03	3 06	3 09	3 13	3 15	3 18
	4	2 52	3 01	3 09	3 16	3 21	3 26	3 35	3 42	3 50	3 57	4 05	4 14	4 19	4 25
	5	3 07	3 23	3 35	3 45	3 54	4 01	4 15	4 27	4 38	4 49	5 01	5 15	5 23	5 32
	6	3 27	3 48	4 04	4 18	4 29	4 40	4 57	5 13	5 27	5 42	5 57	6 15	6 26	6 38
	7	3 52	4 18	4 39	4 55	5 09	5 21	5 42	6 01	6 18	6 35	6 54	7 15	7 28	7 42
	8	4 25	4 56	5 19	5 38	5 54	6 07	6 30	6 51	7 10	7 28	7 49	8 12	8 26	8 42
	9	5 10	5 43	6 07	6 27	6 43	6 57	7 21	7 42	8 01	8 21	8 42	9 06	9 20	9 37
	10	6 06	6 37	7 01	7 20	7 36	7 50	8 13	8 33	8 52	9 11	9 31	9 55	10 08	10 24
	11	7 10	7 39	8 00	8 17	8 32	8 44	9 05	9 24	9 41	9 58	10 17	10 38	10 50	11 05
	12	8 20	8 44	9 01	9 16	9 28	9 39	9 57	10 13	10 28	10 43	10 59	11 17	11 27	11 39
	13	9 33	9 50	10 04	10 16	10 25	10 34	10 48	11 01	11 13	11 25	11 37	11 52	12 00	12 09
	14	10 45	10 58	11 07	11 15	11 22	11 28	11 38	11 48	11 56	12 04	12 13	12 24	12 29	12 36
	15	11 59	12 05	12 11	12 15	12 19	12 22	12 28	12 33	12 38	12 43	12 48	12 54	12 57	13 01
	16	13 13	13 14	13 15	13 16	13 17	13 17	13 19	13 20	13 20	13 21	13 22	13 24	13 24	13 25
	17	14 29	14 25	14 22	14 19	14 16	14 14	14 10	14 07	14 04	14 01	13 58	13 54	13 52	13 50

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	24	4 16	4 37	4 54	5 08	5 19	5 30	5 48	6 03	6 18	6 33	6 48	7 06	7 17	7 29
	25	4 44	5 11	5 33	5 50	6 04	6 17	6 38	6 57	7 15	7 32	7 51	8 13	8 26	8 41
	26	5 25	5 57	6 21	6 41	6 57	7 11	7 35	7 56	8 15	8 34	8 55	9 19	9 33	9 49
	27	6 22	6 56	7 21	7 41	7 57	8 12	8 36	8 57	9 17	9 36	9 57	10 21	10 35	10 51
	28	7 36	8 07	8 30	8 48	9 04	9 17	9 40	9 59	10 17	10 35	10 55	11 17	11 30	11 45
	29	9 01	9 26	9 45	10 00	10 13	10 24	10 44	11 00	11 16	11 31	11 47	12 06	12 17	12 29
	30	10 29	10 47	11 01	11 13	11 23	11 31	11 46	11 59	12 10	12 22	12 35	12 49	12 57	13 06
	31	11 57	12 08	12 17	12 25	12 31	12 36	12 46	12 54	13 02	13 10	13 18	13 27	13 32	13 38
Nov.	1	13 22	13 27	13 31	13 34	13 37	13 40	13 44	13 47	13 51	13 54	13 58	14 02	14 04	14 06
	2	14 46	14 45	14 44	14 43	14 42	14 41	14 40	14 39	14 38	14 37	14 36	14 35	14 34	14 33
	3	16 08	16 01	15 55	15 50	15 46	15 42	15 36	15 30	15 25	15 20	15 14	15 08	15 04	15 00
	4	17 30	17 17	17 06	16 57	16 50	16 43	16 32	16 22	16 13	16 03	15 53	15 42	15 36	15 29
	5	18 51	18 32	18 16	18 04	17 53	17 44	17 28	17 14	17 01	16 48	16 35	16 19	16 10	15 59
	6	20 10	19 44	19 25	19 09	18 56	18 44	18 24	18 07	17 51	17 35	17 18	16 59	16 47	16 34
	7	21 23	20 52	20 30	20 11	19 56	19 43	19 20	19 01	18 43	18 24	18 05	17 43	17 30	17 14
	8	22 25	21 53	21 28	21 09	20 53	20 39	20 15	19 54	19 35	19 15	18 55	18 31	18 17	18 00
	9	23 15	22 43	22 19	22 00	21 44	21 30	21 06	20 45	20 26	20 07	19 46	19 22	19 08	18 52
	10	23 52	23 24	23 02	22 44	22 29	22 16	21 54	21 34	21 16	20 58	20 38	20 16	20 02	19 47
	11	.. ..	23 56	23 37	23 21	23 08	22 57	22 37	22 20	22 04	21 48	21 31	21 11	20 59	20 45
	12	0 20	.. ..	.. ..	23 54	23 43	23 34	23 18	23 03	22 50	22 37	22 22	22 05	21 56	21 45
	13	0 40	0 21	0 06	.. ..	.. ..	.. ..	23 55	23 44	23 34	23 24	23 13	23 00	22 53	22 44
	14	0 56	0 42	0 31	0 22	0 14	0 07	.. ..	.. ..	.. ..	.. ..	.. ..	23 54	23 49	23 44
	15	1 09	1 01	0 54	0 48	0 42	0 38	0 30	0 23	0 16	0 10	0 02	.. ..	.. ..	.. ..
	16	1 21	1 17	1 14	1 12	1 10	1 08	1 04	1 01	0 58	0 55	0 52	0 49	0 47	0 44
	17	1 32	1 34	1 35	1 36	1 37	1 38	1 39	1 40	1 41	1 42	1 43	1 44	1 45	1 46

(.. ..) indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.		+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	24	17 29	17 24	17 17	17 11	17 03	16 55	16 46	16 37	16 25	16 13	15 58	15 40	15 19	14 51
	25	18 16	18 09	18 02	17 54	17 45	17 35	17 24	17 12	16 58	16 42	16 22	15 58	15 26	14 33
	26	19 11	19 04	18 56	18 47	18 38	18 27	18 15	18 02	17 46	17 28	17 05	16 36	15 51	** **
	27	20 16	20 09	20 01	19 52	19 43	19 33	19 21	19 08	18 53	18 35	18 13	17 45	17 03	** **
	28	21 26	21 20	21 13	21 05	20 57	20 48	20 38	20 27	20 14	19 59	19 42	19 20	18 51	18 09
	29	22 38	22 33	22 28	22 22	22 16	22 09	22 01	21 53	21 43	21 32	21 19	21 04	20 46	20 22
	30	23 51	23 47	23 43	23 39	23 35	23 30	23 25	23 19	23 12	23 05	22 57	22 47	22 36	22 23
	31	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
Nov.	1	1 01	0 59	0 57	0 55	0 52	0 50	0 47	0 44	0 40	0 36	0 32	0 27	0 21	0 14
	2	2 10	2 10	2 09	2 09	2 08	2 08	2 07	2 07	2 06	2 05	2 04	2 03	2 02	2 01
	3	3 18	3 19	3 20	3 22	3 23	3 25	3 26	3 28	3 30	3 32	3 35	3 38	3 41	3 45
	4	4 25	4 28	4 31	4 34	4 37	4 41	4 45	4 49	4 54	4 59	5 05	5 12	5 20	5 30
	5	5 32	5 36	5 41	5 45	5 51	5 56	6 02	6 09	6 17	6 26	6 36	6 47	7 01	7 18
	6	6 38	6 44	6 49	6 56	7 03	7 10	7 19	7 28	7 39	7 51	8 05	8 22	8 43	9 11
	7	7 42	7 49	7 56	8 03	8 12	8 21	8 31	8 43	8 56	9 12	9 31	9 54	10 25	11 15
	8	8 42	8 49	8 57	9 06	9 15	9 25	9 37	9 50	10 06	10 24	10 46	11 15	11 59	-- --
	9	9 37	9 44	9 52	10 01	10 10	10 21	10 33	10 46	11 02	11 21	11 44	12 14	13 02	-- --
	10	10 24	10 31	10 39	10 47	10 56	11 06	11 17	11 30	11 45	12 02	12 23	12 49	13 27	15 04
	11	11 05	11 11	11 18	11 25	11 33	11 42	11 52	12 03	12 15	12 30	12 47	13 08	13 34	14 12
	12	11 39	11 45	11 50	11 56	12 03	12 10	12 18	12 27	12 37	12 49	13 02	13 18	13 36	14 00
	13	12 09	12 13	12 18	12 23	12 28	12 33	12 40	12 46	12 54	13 02	13 12	13 23	13 36	13 52
	14	12 36	12 39	12 42	12 45	12 49	12 53	12 57	13 02	13 07	13 13	13 19	13 27	13 35	13 45
	15	13 01	13 03	13 04	13 06	13 08	13 10	13 13	13 15	13 18	13 21	13 25	13 29	13 33	13 39
	16	13 25	13 25	13 26	13 26	13 27	13 27	13 27	13 28	13 29	13 29	13 30	13 31	13 32	13 33
	17	13 50	13 49	13 48	13 46	13 45	13 44	13 42	13 41	13 39	13 37	13 35	13 33	13 30	13 27

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	24	7 29	7 35	7 40	7 47	7 54	8 01	8 10	8 19	8 29	8 42	8 56	9 13	9 33	10 00
	25	8 41	8 47	8 54	9 02	9 11	9 20	9 31	9 42	9 56	10 12	10 31	10 55	11 27	12 19
	26	9 49	9 57	10 05	10 13	10 23	10 33	10 45	10 58	11 14	11 32	11 55	12 24	13 09	** **
	27	10 51	10 59	11 07	11 15	11 25	11 35	11 47	12 00	12 15	12 33	12 56	13 24	14 06	** **
	28	11 45	11 51	11 58	12 06	12 15	12 24	12 34	12 46	12 59	13 14	13 33	13 55	14 24	15 07
	29	12 29	12 35	12 40	12 47	12 54	13 01	13 09	13 18	13 29	13 40	13 54	14 10	14 29	14 53
	30	13 06	13 10	13 15	13 19	13 24	13 30	13 36	13 42	13 50	13 58	14 07	14 18	14 30	14 45
	31	13 38	13 41	13 43	13 46	13 49	13 53	13 57	14 01	14 05	14 10	14 16	14 22	14 29	14 38
Nov.	1	14 06	14 08	14 09	14 10	14 11	14 13	14 14	14 16	14 18	14 20	14 23	14 25	14 28	14 32
	2	14 33	14 33	14 33	14 32	14 32	14 31	14 31	14 30	14 30	14 29	14 28	14 27	14 27	14 25
	3	15 00	14 59	14 57	14 55	14 52	14 50	14 47	14 45	14 41	14 38	14 34	14 30	14 25	14 19
	4	15 29	15 25	15 22	15 18	15 14	15 10	15 05	15 00	14 54	14 48	14 41	14 33	14 24	14 13
	5	15 59	15 55	15 50	15 45	15 39	15 33	15 26	15 19	15 10	15 01	14 50	14 38	14 23	14 05
	6	16 34	16 29	16 22	16 16	16 08	16 00	15 51	15 42	15 30	15 18	15 03	14 45	14 24	13 55
	7	17 14	17 08	17 00	16 53	16 44	16 34	16 24	16 12	15 58	15 42	15 23	14 59	14 28	13 37
	8	18 00	17 53	17 45	17 36	17 27	17 17	17 05	16 51	16 36	16 18	15 55	15 26	14 42	-- --
	9	18 52	18 44	18 36	18 28	18 18	18 07	17 56	17 42	17 26	17 08	16 45	16 14	15 26	-- --
	10	19 47	19 40	19 33	19 25	19 16	19 06	18 55	18 42	18 28	18 11	17 50	17 24	16 47	15 13
	11	20 45	20 39	20 33	20 26	20 18	20 09	20 00	19 49	19 37	19 23	19 06	18 46	18 20	17 43
	12	21 45	21 40	21 34	21 29	21 22	21 15	21 08	20 59	20 50	20 39	20 26	20 12	19 54	19 31
	13	22 44	22 41	22 37	22 32	22 28	22 23	22 17	22 11	22 04	21 56	21 47	21 37	21 25	21 11
	14	23 44	23 42	23 39	23 36	23 33	23 30	23 26	23 23	23 18	23 13	23 08	23 02	22 54	22 46
	15	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
	16	0 44	0 43	0 42	0 41	0 40	0 38	0 37	0 35	0 33	0 31	0 29	0 26	0 23	0 19
	17	1 46	1 46	1 47	1 47	1 47	1 48	1 48	1 49	1 50	1 50	1 51	1 52	1 53	1 54

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov. 16	13 13	13 14	13 15	13 16	13 17	13 17	13 19	13 20	13 20	13 21	13 22	13 24	13 24	13 25
17	14 29	14 25	14 22	14 19	14 16	14 14	14 10	14 07	14 04	14 01	13 58	13 54	13 52	13 50
18	15 49	15 39	15 31	15 24	15 18	15 13	15 04	14 57	14 49	14 42	14 35	14 27	14 22	14 16
19	17 13	16 57	16 43	16 33	16 23	16 15	16 02	15 50	15 39	15 28	15 16	15 03	14 55	14 46
20	18 40	18 17	17 59	17 44	17 32	17 21	17 03	16 47	16 32	16 17	16 02	15 44	15 34	15 22
21	20 07	19 37	19 15	18 57	18 42	18 29	18 07	17 48	17 30	17 13	16 54	16 32	16 20	16 05
22	21 25	20 52	20 27	20 07	19 51	19 36	19 12	18 52	18 32	18 13	17 52	17 28	17 14	16 58
23	22 27	21 54	21 30	21 10	20 54	20 40	20 16	19 55	19 36	19 17	18 56	18 32	18 18	18 01
24	23 11	22 43	22 22	22 04	21 50	21 37	21 15	20 56	20 39	20 21	20 02	19 40	19 27	19 12
25	23 41	23 20	23 03	22 49	22 37	22 27	22 09	21 53	21 38	21 24	21 08	20 50	20 39	20 27
26	.. ..	23 48	23 36	23 26	23 17	23 09	22 56	22 45	22 34	22 23	22 11	21 58	21 50	21 41
27	0 03	.. ..	.. ..	23 57	23 52	23 47	23 39	23 32	23 25	23 19	23 11	23 03	22 59	22 53
28	0 19	0 10	0 03	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
29	0 33	0 30	0 27	0 25	0 23	0 22	0 19	0 16	0 14	0 12	0 09	0 06	0 05	0 03
30	0 46	0 48	0 50	0 52	0 53	0 55	0 57	0 59	1 01	1 03	1 05	1 07	1 09	1 10
Dec. 1	0 59	1 07	1 13	1 19	1 23	1 27	1 35	1 41	1 47	1 53	2 00	2 07	2 12	2 17
2	1 14	1 27	1 38	1 47	1 55	2 02	2 13	2 24	2 34	2 44	2 55	3 07	3 14	3 23
3	1 31	1 50	2 05	2 18	2 29	2 38	2 54	3 09	3 22	3 35	3 50	4 07	4 17	4 28
4	1 54	2 18	2 37	2 53	3 06	3 18	3 38	3 55	4 12	4 28	4 46	5 06	5 18	5 32
5	2 24	2 53	3 16	3 34	3 49	4 02	4 24	4 44	5 02	5 21	5 41	6 03	6 17	6 33
6	3 04	3 36	4 01	4 20	4 36	4 50	5 14	5 35	5 54	6 13	6 34	6 58	7 12	7 29
7	3 56	4 28	4 52	5 12	5 28	5 42	6 06	6 26	6 45	7 04	7 25	7 49	8 02	8 19
8	4 58	5 28	5 50	6 08	6 23	6 36	6 58	7 17	7 35	7 53	8 12	8 34	8 47	9 02
9	6 07	6 32	6 51	7 06	7 19	7 31	7 50	8 07	8 23	8 38	8 55	9 14	9 26	9 38
10	7 18	7 38	7 53	8 06	8 16	8 25	8 41	8 55	9 08	9 21	9 35	9 51	10 00	10 10

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov. 16	1 21	1 17	1 14	1 12	1 10	1 08	1 04	1 01	0 58	0 55	0 52	0 49	0 47	0 44
17	1 32	1 34	1 35	1 36	1 37	1 38	1 39	1 40	1 41	1 42	1 43	1 44	1 45	1 46
18	1 45	1 51	1 57	2 01	2 05	2 09	2 15	2 20	2 25	2 30	2 36	2 42	2 46	2 50
19	1 59	2 11	2 21	2 29	2 36	2 43	2 54	3 03	3 12	3 22	3 31	3 42	3 49	3 56
20	2 17	2 35	2 50	3 02	3 12	3 21	3 37	3 51	4 03	4 16	4 30	4 46	4 56	5 06
21	2 41	3 06	3 25	3 41	3 54	4 06	4 25	4 43	4 59	5 16	5 33	5 53	6 05	6 19
22	3 17	3 47	4 10	4 28	4 44	4 58	5 21	5 41	5 59	6 18	6 38	7 01	7 15	7 31
23	4 08	4 42	5 07	5 27	5 43	5 57	6 22	6 43	7 02	7 22	7 43	8 07	8 21	8 38
24	5 19	5 51	6 15	6 34	6 50	7 04	7 27	7 47	8 06	8 25	8 45	9 08	9 21	9 37
25	6 44	7 10	7 31	7 47	8 01	8 13	8 33	8 51	9 08	9 24	9 41	10 01	10 13	10 26
26	8 14	8 34	8 49	9 02	9 13	9 22	9 38	9 52	10 05	10 18	10 32	10 47	10 56	11 06
27	9 44	9 57	10 07	10 16	10 23	10 29	10 40	10 50	10 59	11 07	11 17	11 27	11 33	11 40
28	11 11	11 17	11 22	11 27	11 30	11 34	11 39	11 44	11 49	11 53	11 58	12 03	12 06	12 10
29	12 34	12 35	12 35	12 35	12 35	12 36	12 36	12 36	12 36	12 37	12 37	12 37	12 37	12 37
30	13 56	13 51	13 46	13 42	13 39	13 36	13 31	13 27	13 23	13 19	13 15	13 10	13 07	13 04
Dec. 1	15 17	15 05	14 56	14 48	14 42	14 36	14 26	14 18	14 09	14 01	13 53	13 43	13 37	13 31
2	16 37	16 19	16 05	15 54	15 44	15 36	15 21	15 09	14 57	14 45	14 32	14 18	14 10	14 01
3	17 55	17 32	17 13	16 59	16 46	16 35	16 17	16 01	15 46	15 31	15 15	14 56	14 46	14 34
4	19 09	18 40	18 19	18 01	17 47	17 34	17 12	16 53	16 36	16 18	16 00	15 38	15 26	15 11
5	20 15	19 43	19 19	19 00	18 44	18 30	18 07	17 46	17 27	17 08	16 48	16 24	16 11	15 55
6	21 09	20 37	20 13	19 53	19 37	19 23	18 59	18 38	18 19	17 59	17 39	17 15	17 00	16 44
7	21 51	21 21	20 58	20 40	20 24	20 11	19 48	19 28	19 10	18 51	18 31	18 08	17 54	17 38
8	22 22	21 56	21 36	21 20	21 06	20 54	20 33	20 15	19 58	19 41	19 23	19 02	18 50	18 36
9	22 44	22 24	22 07	21 54	21 42	21 32	21 15	20 59	20 45	20 31	20 15	19 57	19 47	19 35
10	23 02	22 46	22 34	22 23	22 14	22 06	21 53	21 41	21 29	21 18	21 06	20 52	20 44	20 34

(.. ..) indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov. 16	13 25	13 25	13 26	13 26	13 27	13 27	13 27	13 28	13 29	13 29	13 30	13 31	13 32	13 33
17	13 50	13 49	13 48	13 46	13 45	13 44	13 42	13 41	13 39	13 37	13 35	13 33	13 30	13 27
18	14 16	14 14	14 11	14 09	14 06	14 02	13 59	13 55	13 51	13 46	13 41	13 35	13 29	13 21
19	14 46	14 42	14 38	14 34	14 29	14 24	14 19	14 12	14 06	13 58	13 49	13 40	13 28	13 15
20	15 22	15 17	15 11	15 05	14 59	14 51	14 44	14 35	14 25	14 14	14 02	13 47	13 29	13 07
21	16 05	15 59	15 52	15 44	15 36	15 27	15 17	15 06	14 54	14 39	14 22	14 01	13 34	12 56
22	16 58	16 51	16 43	16 35	16 26	16 15	16 04	15 51	15 36	15 18	14 57	14 29	13 50	** **
23	18 01	17 54	17 46	17 38	17 28	17 18	17 06	16 52	16 37	16 19	15 56	15 27	14 43	** **
24	19 12	19 06	18 58	18 50	18 42	18 32	18 22	18 10	17 56	17 40	17 21	16 57	16 24	15 30
25	20 27	20 21	20 15	20 09	20 02	19 54	19 46	19 37	19 26	19 14	19 00	18 43	18 22	17 54
26	21 41	21 37	21 33	21 28	21 23	21 18	21 12	21 05	20 58	20 50	20 40	20 29	20 16	20 00
27	22 53	22 51	22 48	22 45	22 43	22 39	22 36	22 32	22 28	22 23	22 17	22 11	22 04	21 56
28	.. ..	.. ..	.. ..	.. ..	23 59	23 58	23 57	23 56	23 54	23 53	23 51	23 49	23 46	23 44
29	0 03	0 02	0 01	0 00	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
30	1 10	1 11	1 12	1 13	1 14	1 15	1 16	1 17	1 18	1 19	1 21	1 23	1 25	1 27
Dec. 1	2 17	2 19	2 21	2 24	2 27	2 30	2 33	2 37	2 41	2 45	2 50	2 56	3 02	3 10
2	3 23	3 26	3 30	3 34	3 39	3 44	3 49	3 56	4 02	4 10	4 19	4 29	4 40	4 55
3	4 28	4 33	4 38	4 44	4 50	4 57	5 05	5 14	5 23	5 34	5 47	6 02	6 20	6 43
4	5 32	5 38	5 44	5 52	6 00	6 08	6 18	6 29	6 41	6 56	7 13	7 34	8 01	8 40
5	6 33	6 40	6 47	6 55	7 04	7 14	7 26	7 38	7 53	8 10	8 31	8 58	9 37	-- --
6	7 29	7 36	7 44	7 53	8 02	8 13	8 25	8 38	8 54	9 13	9 36	10 06	10 54	-- --
7	8 19	8 26	8 34	8 42	8 51	9 02	9 13	9 26	9 41	9 59	10 21	10 49	11 31	-- --
8	9 02	9 08	9 15	9 23	9 32	9 41	9 51	10 03	10 16	10 32	10 50	11 13	11 43	12 28
9	9 38	9 44	9 50	9 57	10 04	10 12	10 21	10 30	10 41	10 54	11 08	11 25	11 46	12 14
10	10 10	10 15	10 19	10 25	10 30	10 37	10 43	10 51	10 59	11 09	11 20	11 32	11 47	12 05

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov. 16	0 44	0 43	0 42	0 41	0 40	0 38	0 37	0 35	0 33	0 31	0 29	0 26	0 23	0 19
17	1 46	1 46	1 47	1 47	1 47	1 48	1 48	1 49	1 50	1 50	1 51	1 52	1 53	1 54
18	2 50	2 51	2 53	2 55	2 58	3 00	3 03	3 05	3 09	3 12	3 16	3 21	3 26	3 32
19	3 56	4 00	4 03	4 07	4 11	4 15	4 20	4 26	4 32	4 38	4 46	4 55	5 05	5 17
20	5 06	5 11	5 16	5 22	5 28	5 34	5 42	5 50	5 59	6 09	6 21	6 35	6 52	7 13
21	6 19	6 25	6 31	6 39	6 46	6 55	7 04	7 15	7 27	7 41	7 58	8 19	8 45	9 22
22	7 31	7 38	7 45	7 54	8 03	8 13	8 24	8 37	8 52	9 09	9 30	9 57	10 36	** **
23	8 38	8 45	8 53	9 02	9 11	9 22	9 34	9 47	10 03	10 21	10 44	11 13	11 57	** **
24	9 37	9 43	9 51	9 59	10 08	10 18	10 28	10 41	10 55	11 11	11 31	11 55	12 28	13 23
25	10 26	10 32	10 38	10 45	10 52	11 00	11 09	11 19	11 30	11 43	11 58	12 16	12 37	13 06
26	11 06	11 11	11 15	11 21	11 26	11 32	11 39	11 46	11 54	12 03	12 14	12 26	12 40	12 57
27	11 40	11 43	11 46	11 50	11 53	11 57	12 02	12 07	12 12	12 18	12 24	12 32	12 40	12 50
28	12 10	12 11	12 13	12 15	12 17	12 19	12 21	12 23	12 26	12 28	12 32	12 35	12 39	12 44
29	12 37	12 37	12 37	12 37	12 37	12 37	12 38	12 38	12 38	12 38	12 38	12 38	12 38	12 38
30	13 04	13 02	13 01	12 59	12 58	12 56	12 54	12 52	12 49	12 47	12 44	12 40	12 37	12 32
Dec. 1	13 31	13 28	13 25	13 22	13 19	13 15	13 11	13 07	13 02	12 56	12 50	12 43	12 35	12 26
2	14 01	13 56	13 52	13 47	13 42	13 37	13 30	13 24	13 16	13 08	12 58	12 47	12 34	12 19
3	14 34	14 28	14 22	14 16	14 09	14 02	13 54	13 45	13 35	13 23	13 10	12 54	12 35	12 11
4	15 11	15 05	14 58	14 50	14 42	14 33	14 23	14 12	13 59	13 44	13 27	13 05	12 38	11 58
5	15 55	15 48	15 40	15 31	15 22	15 12	15 01	14 48	14 33	14 15	13 54	13 27	12 48	-- --
6	16 44	16 37	16 29	16 20	16 10	16 00	15 48	15 34	15 19	15 00	14 37	14 06	13 19	-- --
7	17 38	17 31	17 23	17 15	17 06	16 56	16 44	16 31	16 16	15 59	15 37	15 09	14 28	-- --
8	18 36	18 29	18 22	18 15	18 07	17 58	17 48	17 36	17 23	17 08	16 50	16 28	15 58	15 13
9	19 35	19 29	19 24	19 17	19 11	19 03	18 55	18 46	18 35	18 23	18 09	17 53	17 32	17 06
10	20 34	20 30	20 26	20 21	20 16	20 10	20 04	19 57	19 49	19 40	19 30	19 18	19 04	18 47

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

MOONRISE AND MOONSET, 1991

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Dec. 9	6 07	6 32	6 51	7 06	7 19	7 31	7 50	8 07	8 23	8 38	8 55	9 14	9 26	9 38
10	7 18	7 38	7 53	8 06	8 16	8 25	8 41	8 55	9 08	9 21	9 35	9 51	10 00	10 10
11	8 30	8 44	8 56	9 05	9 13	9 20	9 32	9 42	9 52	10 01	10 12	10 23	10 30	10 38
12	9 43	9 51	9 58	10 04	10 09	10 13	10 21	10 27	10 34	10 40	10 46	10 54	10 58	11 03
13	10 55	10 58	11 01	11 03	11 05	11 07	11 10	11 12	11 15	11 17	11 20	11 23	11 25	11 27
14	12 08	12 06	12 05	12 03	12 02	12 01	11 59	11 58	11 57	11 55	11 54	11 52	11 51	11 50
15	13 24	13 17	13 11	13 06	13 01	12 57	12 51	12 45	12 40	12 35	12 29	12 23	12 19	12 15
16	14 44	14 30	14 20	14 11	14 03	13 56	13 45	13 35	13 26	13 17	13 07	12 56	12 50	12 42
17	16 08	15 48	15 32	15 19	15 08	14 59	14 43	14 29	14 16	14 03	13 49	13 34	13 24	13 14
18	17 34	17 07	16 47	16 31	16 17	16 05	15 45	15 27	15 11	14 54	14 37	14 17	14 06	13 53
19	18 57	18 25	18 01	17 42	17 26	17 13	16 49	16 29	16 10	15 52	15 32	15 09	14 56	14 40
20	20 08	19 35	19 10	18 50	18 33	18 19	17 55	17 34	17 14	16 55	16 34	16 09	15 55	15 39
21	21 02	20 32	20 09	19 50	19 35	19 21	18 58	18 38	18 19	18 00	17 40	17 17	17 03	16 48
22	21 40	21 15	20 56	20 41	20 27	20 16	19 56	19 39	19 22	19 06	18 49	18 29	18 17	18 03
23	22 06	21 48	21 34	21 22	21 12	21 03	20 48	20 35	20 22	20 09	19 56	19 40	19 31	19 21
24	22 25	22 14	22 05	21 57	21 50	21 45	21 35	21 26	21 17	21 09	21 00	20 50	20 44	20 37
25	22 40	22 35	22 31	22 27	22 24	22 22	22 17	22 13	22 09	22 05	22 01	21 56	21 54	21 51
26	22 54	22 54	22 55	22 55	22 56	22 56	22 57	22 57	22 58	22 58	22 59	23 00	23 00	23 01
27	23 07	23 13	23 18	23 22	23 26	23 29	23 35	23 40	23 45	23 50	23 55	.. ..	.. ..	.. ..
28	23 21	23 33	23 42	23 50	23 57	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 01	0 05	0 09
29	23 37	23 55	.. ..	.. ..	.. ..	0 03	0 14	0 23	0 32	0 41	0 51	1 02	1 08	1 15
30	23 58	.. ..	0 09	0 20	0 30	0 39	0 54	1 07	1 20	1 32	1 46	2 01	2 10	2 21
31	.. ..	0 21	0 39	0 54	1 06	1 17	1 36	1 53	2 08	2 24	2 41	3 00	3 12	3 25
32	0 25	0 53	1 15	1 32	1 47	2 00	2 22	2 41	2 58	3 16	3 36	3 58	4 11	4 26
33	1 02	1 33	1 57	2 16	2 32	2 46	3 10	3 30	3 49	4 09	4 29	4 53	5 07	5 23

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Dec. 9	22 44	22 24	22 07	21 54	21 42	21 32	21 15	20 59	20 45	20 31	20 15	19 57	19 47	19 35
10	23 02	22 46	22 34	22 23	22 14	22 06	21 53	21 41	21 29	21 18	21 06	20 52	20 44	20 34
11	23 16	23 05	22 57	22 49	22 43	22 38	22 28	22 20	22 12	22 04	21 55	21 46	21 40	21 33
12	23 28	23 22	23 17	23 14	23 10	23 07	23 02	22 58	22 53	22 49	22 44	22 39	22 36	22 32
13	23 39	23 38	23 38	23 37	23 37	23 36	23 36	23 35	23 35	23 34	23 34	23 33	23 32	23 32
14	23 50	23 55	23 58	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
15	.. ..	.. ..	.. ..	0 01	0 04	0 06	0 10	0 14	0 17	0 20	0 24	0 28	0 30	0 33
16	0 03	0 12	0 20	0 27	0 33	0 38	0 46	0 54	1 01	1 09	1 16	1 25	1 31	1 36
17	0 18	0 34	0 46	0 56	1 05	1 13	1 26	1 38	1 49	2 00	2 12	2 26	2 34	2 43
18	0 38	1 00	1 17	1 31	1 43	1 53	2 11	2 27	2 41	2 56	3 12	3 30	3 41	3 53
19	1 07	1 35	1 56	2 13	2 28	2 40	3 02	3 21	3 39	3 56	4 15	4 37	4 50	5 05
20	1 50	2 22	2 47	3 06	3 22	3 36	4 00	4 21	4 40	5 00	5 20	5 44	5 58	6 15
21	2 52	3 25	3 50	4 10	4 26	4 41	5 05	5 26	5 45	6 04	6 25	6 49	7 03	7 19
22	4 13	4 42	5 05	5 23	5 38	5 51	6 13	6 32	6 50	7 07	7 26	7 47	8 00	8 14
23	5 45	6 08	6 26	6 40	6 52	7 03	7 21	7 37	7 51	8 06	8 21	8 39	8 49	9 00
24	7 19	7 35	7 47	7 58	8 06	8 14	8 27	8 38	8 49	8 59	9 10	9 23	9 30	9 38
25	8 51	9 00	9 07	9 13	9 18	9 22	9 30	9 36	9 42	9 48	9 55	10 02	10 06	10 11
26	10 18	10 21	10 23	10 24	10 26	10 27	10 29	10 31	10 32	10 34	10 36	10 38	10 39	10 40
27	11 43	11 39	11 36	11 34	11 31	11 29	11 26	11 23	11 20	11 18	11 15	11 11	11 09	11 07
28	13 05	12 55	12 47	12 41	12 35	12 30	12 22	12 15	12 08	12 01	11 53	11 45	11 40	11 35
29	14 26	14 10	13 57	13 47	13 38	13 30	13 17	13 06	12 55	12 44	12 33	12 20	12 12	12 04
30	15 44	15 22	15 06	14 52	14 40	14 30	14 12	13 57	13 43	13 29	13 14	12 57	12 47	12 35
31	16 59	16 32	16 11	15 55	15 40	15 28	15 07	14 49	14 32	14 16	13 58	13 37	13 25	13 11
32	18 07	17 36	17 13	16 54	16 38	16 25	16 02	15 42	15 23	15 04	14 44	14 21	14 08	13 52
33	19 05	18 33	18 08	17 49	17 32	17 18	16 54	16 33	16 14	15 55	15 34	15 10	14 56	14 39

(.. ..) indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Dec. 9	9 38	9 44	9 50	9 57	10 04	10 12	10 21	10 30	10 41	10 54	11 08	11 25	11 46	12 14
10	10 10	10 15	10 19	10 25	10 30	10 37	10 43	10 51	10 59	11 09	11 20	11 32	11 47	12 05
11	10 38	10 41	10 45	10 48	10 53	10 57	11 02	11 07	11 13	11 20	11 28	11 36	11 46	11 58
12	11 03	11 05	11 07	11 10	11 12	11 15	11 18	11 21	11 25	11 29	11 34	11 39	11 45	11 52
13	11 27	11 27	11 28	11 29	11 30	11 31	11 33	11 34	11 35	11 37	11 39	11 41	11 43	11 46
14	11 50	11 50	11 49	11 49	11 48	11 48	11 47	11 46	11 45	11 45	11 44	11 43	11 41	11 40
15	12 15	12 13	12 11	12 09	12 07	12 05	12 02	11 59	11 56	11 53	11 49	11 45	11 40	11 34
16	12 42	12 39	12 36	12 32	12 28	12 24	12 20	12 15	12 09	12 03	11 56	11 48	11 39	11 28
17	13 14	13 10	13 05	13 00	12 54	12 48	12 41	12 34	12 26	12 16	12 06	11 53	11 39	11 22
18	13 53	13 47	13 41	13 34	13 27	13 18	13 10	13 00	12 48	12 36	12 21	12 03	11 41	11 13
19	14 40	14 33	14 26	14 18	14 09	14 00	13 49	13 37	13 23	13 06	12 47	12 23	11 50	10 57
20	15 39	15 31	15 23	15 15	15 05	14 55	14 43	14 30	14 14	13 56	13 33	13 04	12 20	** **
21	16 48	16 41	16 33	16 25	16 15	16 05	15 54	15 41	15 26	15 09	14 48	14 20	13 41	** **
22	18 03	17 57	17 51	17 44	17 36	17 27	17 18	17 07	16 55	16 41	16 24	16 04	15 38	15 02
23	19 21	19 16	19 11	19 06	19 00	18 54	18 47	18 39	18 30	18 20	18 09	17 56	17 39	17 19
24	20 37	20 34	20 31	20 28	20 24	20 20	20 15	20 11	20 05	19 59	19 52	19 44	19 35	19 24
25	21 51	21 49	21 48	21 46	21 45	21 43	21 41	21 39	21 36	21 33	21 30	21 27	21 23	21 18
26	23 01	23 01	23 01	23 02	23 02	23 02	23 03	23 03	23 03	23 04	23 04	23 05	23 06	23 07
27	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
28	0 09	0 11	0 13	0 15	0 17	0 19	0 22	0 25	0 28	0 31	0 35	0 40	0 45	0 51
29	1 15	1 19	1 22	1 26	1 30	1 34	1 39	1 45	1 51	1 57	2 05	2 14	2 24	2 36
30	2 21	2 25	2 30	2 36	2 42	2 48	2 55	3 03	3 12	3 22	3 33	3 47	4 03	4 23
31	3 25	3 31	3 37	3 44	3 51	3 59	4 09	4 19	4 30	4 44	5 00	5 19	5 43	6 16
32	4 26	4 33	4 40	4 48	4 57	5 07	5 17	5 30	5 44	6 00	6 20	6 46	7 21	8 28
33	5 23	5 31	5 39	5 47	5 57	6 07	6 19	6 32	6 48	7 06	7 29	7 59	8 45	-- --

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Dec. 9	19 35	19 29	19 24	19 17	19 11	19 03	18 55	18 46	18 35	18 23	18 09	17 53	17 32	17 06
10	20 34	20 30	20 26	20 21	20 16	20 10	20 04	19 57	19 49	19 40	19 30	19 18	19 04	18 47
11	21 33	21 30	21 27	21 24	21 20	21 17	21 12	21 08	21 02	20 57	20 50	20 42	20 33	20 23
12	22 32	22 31	22 29	22 27	22 25	22 23	22 21	22 19	22 16	22 13	22 09	22 05	22 01	21 55
13	23 32	23 32	23 32	23 31	23 31	23 31	23 30	23 30	23 30	23 29	23 29	23 28	23 28	23 27
14	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
15	0 33	0 34	0 35	0 37	0 38	0 40	0 42	0 43	0 45	0 48	0 50	0 53	0 57	1 01
16	1 36	1 39	1 42	1 45	1 48	1 52	1 55	2 00	2 04	2 09	2 15	2 22	2 30	2 39
17	2 43	2 47	2 51	2 56	3 01	3 07	3 13	3 20	3 27	3 36	3 45	3 57	4 10	4 26
18	3 53	3 58	4 04	4 11	4 17	4 25	4 33	4 43	4 53	5 06	5 20	5 37	5 58	6 25
19	5 05	5 11	5 18	5 26	5 35	5 44	5 55	6 06	6 20	6 36	6 55	7 19	7 51	8 43
20	6 15	6 22	6 30	6 39	6 48	6 58	7 10	7 24	7 39	7 57	8 20	8 49	9 33	** **
21	7 19	7 26	7 34	7 43	7 52	8 02	8 14	8 27	8 42	8 59	9 21	9 48	10 28	** **
22	8 14	8 21	8 28	8 35	8 43	8 52	9 02	9 13	9 26	9 41	9 58	10 19	10 45	11 22
23	9 00	9 05	9 11	9 17	9 23	9 30	9 38	9 46	9 56	10 06	10 19	10 33	10 50	11 11
24	9 38	9 42	9 46	9 50	9 54	9 59	10 04	10 10	10 17	10 24	10 32	10 41	10 51	11 04
25	10 11	10 13	10 15	10 17	10 20	10 23	10 26	10 29	10 32	10 36	10 41	10 45	10 51	10 58
26	10 40	10 40	10 41	10 42	10 42	10 43	10 44	10 44	10 45	10 46	10 47	10 49	10 50	10 52
27	11 07	11 06	11 05	11 04	11 03	11 02	11 00	10 59	10 57	10 56	10 53	10 51	10 49	10 46
28	11 35	11 32	11 30	11 27	11 24	11 21	11 18	11 14	11 10	11 05	11 00	10 54	10 47	10 40
29	12 04	12 00	11 56	11 51	11 47	11 42	11 36	11 30	11 23	11 16	11 07	10 58	10 46	10 33
30	12 35	12 30	12 25	12 19	12 13	12 06	11 58	11 50	11 40	11 30	11 18	11 03	10 46	10 25
31	13 11	13 05	12 58	12 51	12 43	12 35	12 25	12 15	12 03	11 49	11 33	11 13	10 48	10 14
32	13 52	13 45	13 38	13 30	13 21	13 11	13 00	12 47	12 33	12 16	11 56	11 30	10 55	9 48
33	14 39	14 32	14 24	14 15	14 06	13 55	13 43	13 30	13 14	12 56	12 33	12 03	11 16	-- --

(.. ..) indicates phenomenon will occur the next day.
(-- --) indicates Moon continuously below horizon.
(** **) indicates Moon continuously above horizon.

There are six eclipses, two of the Sun and four of the Moon.

I	January 15–16	Annular eclipse of the Sun
II	January 30	Penumbral eclipse of the Moon
III	June 27	Penumbral eclipse of the Moon
IV	July 11	Total eclipse of the Sun
V	July 26	Penumbral eclipse of the Moon
VI	December 21	Partial eclipse of the Moon

A standard correction of +0″.5 has been applied to the tabular longitude of the Moon, and of –0″.25 has been applied to the tabular latitude of the Moon, to help correct for the difference between the center of figure and the center of mass when using the LE200 lunar ephemeris.

The arguments are given provisionally in Universal Time, using $\Delta T(A) = +58^s$. Once the value of ΔT is known, the data on these pages may be expressed in Universal Time as follows:

Define $\delta T = \Delta T - \Delta T(A)$.

Convert all arguments in preliminary Universal Time by subtracting δT.

Apply the correction $1.0027\ \delta T$ to μ and the longitudes in such a way that if δT is positive, μ decreases and the longitudes shift to the east.

Leave all other quantities unchanged.

Longitude is positive to the east, and negative to the west.

I.—*Annular Eclipse of the Sun*, January 15-16.

ELEMENTS OF THE ECLIPSE

U.T. of geocentric conjunction in right ascension January $15^d\ 23^h\ 43^m\ 30^s.177$

Julian Day No. = 2448272.4885437177

	h m s		s	s
R.A. of Sun and Moon	19 49 09.501	Hourly motions	10.736	and 125.389
	° ′ ″			′ ″
Declination of Sun	–21 04 25.58	Hourly motion		+ 0 27.88
Declination of Moon	–21 19 54.65	Hourly motion		+ 8 15.61
Equatorial hor. par. of Sun	8.94	True semidiameter of Sun		16 15.5
Equatorial hor. par. of Moon	54 37.58	True semidiameter of Moon		14 53.1

CIRCUMSTANCES OF THE ECLIPSE

		U.T.	Longitude	Latitude
		d h m	° ′	° ′
Eclipse begins	January	15 20 51.0	+129 29.9	– 24 28.9
Central eclipse begins		15 21 59.9	+109 35.8	– 29 51.9
Central eclipse at local apparent noon		15 23 43.5	– 173 30.5	– 37 47.7
Central eclipse ends		16 01 45.9	– 114 17.3	+ 0 27.4
Eclipse ends		16 02 54.7	– 133 36.7	+ 5 57.0

II.—*Penumbral Eclipse of the Moon*, January 30; the beginning of the penumbral phase visible in extreme eastern Asia, North America, Central America, South America, Greenland, Europe, most of Africa, the Palmer Peninsula of Antarctica, the Arctic regions, the eastern Pacific Ocean, and the Atlantic Ocean; the end visible in extreme eastern Asia, most of New Zealand, North America, Central America, South America, Greenland, the Arctic regions, the Pacific Ocean, and the northern Atlantic Ocean.

ELEMENTS OF THE ECLIPSE

U.T. of geocentric opposition in right ascension January $30^{d}\ 06^{h}\ 42^{m}\ 28^{s}.093$

Julian Day No. = 2448286.7794918155

	h m s		s
R.A. of Sun	20 49 14.562	Hourly motion	10.272
R.A. of Moon	8 49 14.562	Hourly motion	143.049
	° ′ ″		′ ″
Declination of Sun	−17 46 42.82	Hourly motion	+ 0 40.77
Declination of Moon	+16 37 26.86	Hourly motion	− 12 56.88
Equatorial hor. par. of Sun	8.93	True semidiameter of Sun	16 14.2
Equatorial hor. par. of Moon	60 05.55	True semidiameter of Moon	16 22.5

CIRCUMSTANCES OF THE ECLIPSE

		d h m	
Moon enters penumbra	January	30 03 57.8	
Middle of eclipse		30 05 58.6	U.T.
Moon leaves penumbra		30 07 59.4	

Contacts of Penumbra with Limb of Moon	Position Angles from the North Point °	The Moon being in the Zenith in Longitude ° ′	Latitude ° ′
First	67.8 to East	− 57 40.9	+ 17 12.6
Last	25.6 to West	− 115 50.0	+ 16 20.8

Penumbral Magnitude of the Eclipse: 0.906

This eclipse belongs to the initial penumbral series preceding the umbral eclipse of 2063 March 14.

III.—*Penumbral Eclipse of the Moon*, June 27; the beginning of the penumbral phase visible in eastern North America, Central America, South America, Antarctica, Africa, Europe south of Scandanavia, the western Indian Ocean, the Atlantic Ocean, and the southeastern Pacific Ocean; the end visible in North America except for Alaska and northwestern Canada, Central America, South America, Antarctica, the western half of Africa, the western Iberian Peninsula of Europe, the Atlantic Ocean, and the southeastern Pacific Ocean.

Penumbral Eclipse of the Moon, June 27 (continued).

ELEMENTS OF THE ECLIPSE

U.T. of geocentric opposition in right ascension June $27^d\ 02^h\ 52^m\ 00^s.728$

Julian Day No. = 2448434.6194528646

	h m s		s
R.A. of Sun	6 21 44.470	Hourly motion	10.377
R.A. of Moon	18 21 44.470	Hourly motion	129.238
	° ′ ″		′ ″
Declination of Sun	+23 20 49.48	Hourly motion	− 0 05.38
Declination of Moon	−24 37 26.26	Hourly motion	+ 3 45.10
Equatorial hor. par. of Sun	8.65	True semidiameter of Sun	15 44.1
Equatorial hor. par. of Moon	53 58.64	True semidiameter of Moon	14 42.5

CIRCUMSTANCES OF THE ECLIPSE

	d h m	
Moon enters penumbra	June 27 01 46.3	
Middle of eclipse	27 03 14.7	U.T.
Moon leaves penumbra	27 04 43.2	

Contacts of Penumbra with Limb of Moon	Position Angles from the North Point °	The Moon being in the Zenith in Longitude ° ′	Latitude ° ′
First	20.2 to East	− 26 24.0	− 24 41.5
Last	35.6 to West	− 69 09.6	− 24 30.3

Penumbral Magnitude of the Eclipse: 0.339

This eclipse belongs to the terminal penumbral series following the umbral eclipse of 1883 April 22.

IV.—*Total Eclipse of the Sun*, July 11.

ELEMENTS OF THE ECLIPSE

U.T. of geocentric conjunction in right ascension July $11^d\ 19^h\ 06^m\ 08^s.116$

Julian Day No. = 2448449.2959272715

	h m s		s		s
R.A. of Sun and Moon	7 22 12.791	Hourly motions	10.196	and	159.902
	° ′ ″				′ ″
Declination of Sun	+22 05 48.50	Hourly motion			− 0 19.99
Declination of Moon	+22 05 32.75	Hourly motion			− 8 46.34
Equatorial hor. par. of Sun	8.65	True semidiameter of Sun			15 43.9
Equatorial hor. par. of Moon	61 17.72	True semidiameter of Moon			16 42.2

Total Eclipse of the Sun, July 11 (continued).

CIRCUMSTANCES OF THE ECLIPSE

		U.T. d h m	Longitude ° ′	Latitude ° ′
Eclipse begins	July	11 16 28.7	−161 00.1	+12 32.5
Central eclipse begins		11 17 23.2	−174 36.2	+12 28.7
Central eclipse at local apparent noon		11 19 06.1	−105 10.1	+21 59.0
Central eclipse ends		11 20 48.8	− 46 12.2	−12 58.4
Eclipse ends		11 21 43.4	− 59 48.5	−12 54.5

V.—*Penumbral Eclipse of the Moon*, July 26; the beginning of the penumbral phase visible in southern and eastern Africa, most of Asia, Australia, New Zealand, most of Antarctica, the western Pacific Ocean, and the Indian Ocean; the end visible in most of Europe, most of Africa, most of Asia, Australia, southern New Zealand, Antarctica, the eastern South Atlantic Ocean, and the Indian Ocean.

ELEMENTS OF THE ECLIPSE

U.T. of geocentric opposition in right ascension July $26^{d}\ 19^{h}\ 06^{m}\ 05^{s}.663$

Julian Day No. = 2448464.2958988769

	h m s		s
R.A. of Sun	8 22 24.052	Hourly motion	9.852
R.A. of Moon	20 22 24.052	Hourly motion	119.418
	° ′ ″		′ ″
Declination of Sun	+19 25 13.36	Hourly motion	− 0 33.17
Declination of Moon	−18 02 47.70	Hourly motion	+ 9 29.73
Equatorial hor. par. of Sun	8.66	True semidiameter of Sun	15 44.9
Equatorial hor. par. of Moon	54 16.15	True semidiameter of Moon	14 47.3

CIRCUMSTANCES OF THE ECLIPSE

	d h m	
Moon enters penumbra	July 26 16 47.5	
Middle of eclipse	26 18 07.8	U.T.
Moon leaves penumbra	26 19 28.3	

Contacts of Penumbra with Limb of Moon	Position Angles from the North Point °	The Moon being in the Zenith in Longitude ° ′	Latitude ° ′
First	135.8 to East	+108 41.9	− 18 24.5
Last	173.6 to West	+ 69 43.3	− 17 59.3

Penumbral Magnitude of the Eclipse: 0.280

This eclipse belongs to the initial penumbral series preceding the umbral eclipse of 2117 October 10.

VI.—*Partial Eclipse of the Moon*, December 21; the beginning of the umbral phase visible in eastern Australia, New Zealand, northern and eastern Asia, North America, Central America, northwestern South America, Greenland, northern Scandanavia, the Arctic regions, the Pacific Ocean, and the northwestern Atlantic Ocean; the end visible in northern and eastern Asia, Australia, New Zealand, North America, Central America, Greenland, northern Scandanavia, the Arctic regions, and the Pacific Ocean.

ELEMENTS OF THE ELIPSE

U.T. of geocentric opposition in right ascension December $21^d\ 10^h\ 23^m\ 54^s.176$

Julian Day No. = 2448611.9332659279

	h m s		s
R.A. of Sun	17 55 50.389	Hourly motion	11.095
R.A. of Moon	5 55 50.389	Hourly motion	165.352
	° ′ ″		′ ″
Declination of Sun	−23 26 13.76	Hourly motion	− 0 01.11
Declination of Moon	+24 25 43.95	Hourly motion	− 3 08.95
Equatorial hor. par. of Sun	8.94	True semidiameter of Sun	16 15.5
Equatorial hor. par. of Moon	61 02.48	True semidiameter of Moon	16 38.0

CIRCUMSTANCES OF THE ECLIPSE

	d h m	
Moon enters penumbra	December 21 08 25.4	
Moon enters umbra	21 10 00.0	
Middle of eclipse	21 10 33.0	U.T.
Moon leaves umbra	21 11 06.1	
Moon leaves penumbra	21 12 40.6	

Contacts of Umbra with Limb of Moon	Position Angles from the North Point °	The Moon being in the Zenith in Longitude ° ′	Latitude ° ′
First	167.0 to East	− 150 47.2	+ 24 27.0
Last	156.6 to West	− 166 37.0	+ 24 23.5

Magnitude of the Eclipse: 0.093

BESSELIAN ELEMENTS: ANNULAR SOLAR ECLIPSE OF JANUARY 15-16

U.T.	Intersection of Axis of Shadow with Fundamental Plane		Direction of Axis of Shadow			Radius of Shadow on Fundamental Plane	
	x	y	$\sin d$	$\cos d$	μ	Penumbra	Umbra
h m					°		
20 30	−1.580778	−0.744387	−0.359945	0.932973	125.14080	0.571835	+0.025322
40	1.499089	0.720688	.359925	.932981	127.64040	.571834	.025321
50	1.417398	0.696980	.359905	.932989	130.14001	.571832	.025320
21 00	−1.335707	−0.673263	−0.359885	0.932997	132.63961	0.571830	+0.025317
10	1.254014	0.649537	.359865	.933004	135.13922	.571827	.025315
20	1.172321	0.625802	.359845	.933012	137.63882	.571824	.025311
30	1.090627	0.602059	.359825	.933020	140.13843	.571820	.025307
40	1.008932	0.578306	.359806	.933027	142.63803	.571816	.025303
50	0.927237	0.554545	.359786	.933035	145.13764	.571811	.025298
22 00	−0.845542	−0.530775	−0.359766	0.933043	147.63724	0.571805	+0.025292
10	0.763847	0.506996	.359746	.933050	150.13685	.571799	.025286
20	0.682152	0.483209	.359725	.933058	152.63645	.571792	.025280
30	0.600457	0.459413	.359705	.933066	155.13606	.571785	.025273
40	0.518763	0.435608	.359685	.933074	157.63566	.571777	.025265
50	0.437069	0.411795	.359665	.933081	160.13527	.571769	.025256
23 00	−0.355376	−0.387974	−0.359645	0.933089	162.63488	0.571760	+0.025247
10	0.273684	0.364144	.359625	.933097	165.13448	.571750	.025238
20	0.191993	0.340306	.359605	.933104	167.63409	.571740	.025228
30	0.110303	0.316460	.359585	.933112	170.13370	.571730	.025217
40	−0.028615	0.292605	.359565	.933120	172.63330	.571718	.025206
50	+0.053072	0.268742	.359545	.933128	175.13291	.571707	.025195
0 00	+0.134757	−0.244871	−0.359525	0.933135	177.63252	0.571694	+0.025182
10	0.216441	0.220992	.359505	.933143	180.13212	.571681	.025169
20	0.298122	0.197105	.359485	.933151	182.63173	.571668	.025156
30	0.379801	0.173210	.359465	.933159	185.13134	.571654	.025142
40	0.461478	0.149307	.359445	.933166	187.63094	.571639	.025128
50	0.543152	0.125396	.359425	.933174	190.13055	.571624	.025113
1 00	+0.624824	−0.101477	−0.359405	0.933182	192.63016	0.571608	+0.025097
10	0.706493	0.077551	.359385	.933190	195.12977	.571592	.025081
20	0.788159	0.053616	.359364	.933197	197.62937	.571575	.025064
30	0.869822	0.029674	.359344	.933205	200.12898	.571558	.025047
40	0.951481	−0.005725	.359324	.933213	202.62859	.571540	.025029
50	1.033138	+0.018233	.359304	.933221	205.12820	.571521	.025010
2 00	+1.114790	+0.042197	−0.359284	0.933228	207.62781	0.571502	+0.024991
10	1.196439	0.066170	.359264	.933236	210.12741	.571483	.024972
20	1.278084	0.090149	.359244	.933244	212.62702	.571462	.024952
30	1.359725	0.114136	.359224	.933252	215.12663	.571442	.024931
40	1.441362	0.138131	.359203	.933259	217.62624	.571420	.024910
50	1.522995	0.162132	.359183	.933267	220.12585	.571398	.024888
3 00	+1.604623	+0.186141	−0.359163	0.933275	222.62546	0.571376	+0.024865
10	1.686246	0.210157	0.359143	0.933283	225.12507	0.571353	0.024842
20	+1.767864	+0.234181	−0.359123	0.933290	227.62468	0.571329	+0.024819

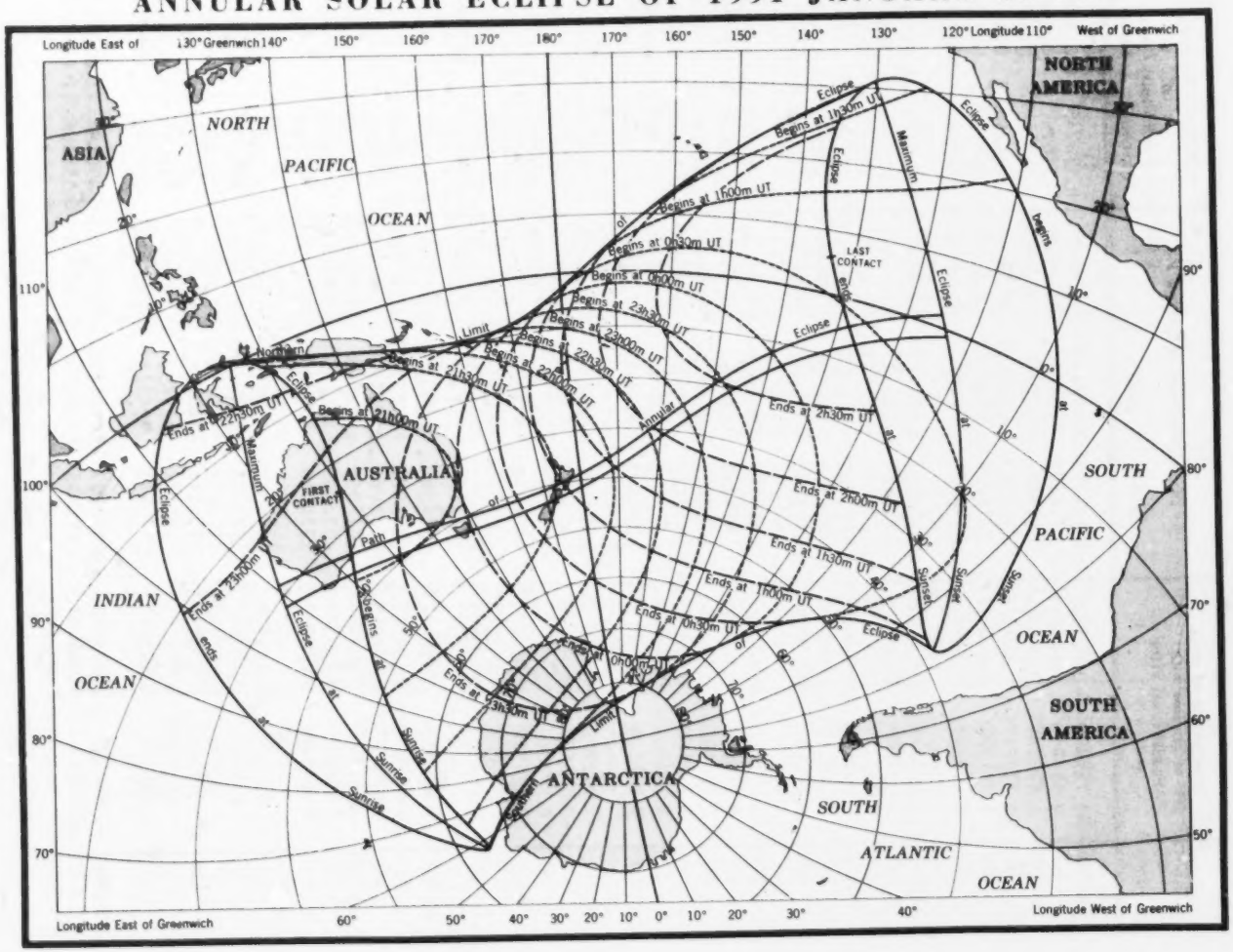
$\tan f_1$	0.004754
$\tan f_2$	0.004731
μ'	0.261758 radians per hour
d'	+0.000129 radians per hour

BESSELIAN ELEMENTS: TOTAL SOLAR ECLIPSE OF JULY 11

U.T.	Intersection of Axis of Shadow with Fundamental Plane		Direction of Axis of Shadow			Radius of Shadow on Fundamental Plane	
	x	y	$\sin d$	$\cos d$	μ	Penumbra	Umbra
h m					°		
16 00	−1.759479	+0.422321	+0.376434	0.926443	58.63472	0.530245	−0.016060
10	1.664960	0.399483	.376420	.926449	61.13473	.530262	.016044
20	1.570440	0.376636	.376406	.926455	63.63474	.530277	.016028
30	1.475917	0.353779	.376392	.926461	66.13475	.530293	.016013
40	1.381392	0.330912	.376378	.926466	68.63476	.530307	.015998
50	1.286866	0.308036	.376364	.926472	71.13477	.530321	.015985
17 00	−1.192338	+0.285150	+0.376350	0.926478	73.63477	0.530334	−0.015972
10	1.097809	0.262255	.376336	.926483	76.13478	.530346	.015959
20	1.003279	0.239351	.376322	.926489	78.63479	.530358	.015948
30	0.908748	0.216438	.376308	.926495	81.13480	.530369	.015937
40	0.814218	0.193516	.376294	.926500	83.63481	.530379	.015927
50	0.719687	0.170584	.376280	.926506	86.13482	.530388	.015918
18 00	−0.625156	+0.147644	+0.376266	0.926512	88.63483	0.530397	−0.015909
10	0.530626	0.124694	.376252	.926517	91.13483	.530405	.015901
20	0.436097	0.101736	.376238	.926523	93.63484	.530412	.015894
30	0.341568	0.078769	.376224	.926529	96.13485	.530419	.015887
40	0.247041	0.055794	.376210	.926535	98.63486	.530425	.015881
50	0.152516	0.032810	.376195	.926540	101.13487	.530430	.015876
19 00	−0.057992	+0.009817	+0.376181	0.926546	103.63488	0.530435	−0.015871
10	+0.036530	−0.013184	.376167	.926552	106.13489	.530438	.015868
20	0.131049	0.036194	.376153	.926557	108.63490	.530441	.015865
30	0.225566	0.059212	.376139	.926563	111.13491	.530444	.015862
40	0.320080	0.082239	.376125	.926569	113.63492	.530445	.015861
50	0.414590	0.105273	.376111	.926575	116.13493	.530446	.015860
20 00	+0.509098	−0.128316	+0.376097	0.926580	118.63494	0.530447	−0.015859
10	0.603601	0.151367	.376083	.926586	121.13495	.530446	.015860
20	0.698101	0.174425	.376069	.926592	123.63496	.530445	.015861
30	0.792596	0.197492	.376055	.926598	126.13497	.530443	.015863
40	0.887087	0.220566	.376040	.926603	128.63498	.530440	.015866
50	0.981574	0.243649	.376026	.926609	131.13499	.530437	.015869
21 00	+1.076055	−0.266739	+0.376012	0.926615	133.63500	0.530433	−0.015873
10	1.170531	0.289837	.375998	.926620	136.13501	.530428	.015878
20	1.265001	0.312942	.375984	.926626	138.63502	.530423	.015883
30	1.359466	0.336055	.375970	.926632	141.13503	.530417	.015889
40	1.453924	0.359175	.375956	.926638	143.63504	.530410	.015896
50	1.548376	0.382303	.375942	.926643	146.13505	.530402	.015904
22 00	+1.642822	−0.405438	+0.375927	0.926649	148.63506	0.530394	−0.015912
10	+1.737261	−0.428580	+0.375913	0.926655	151.13507	0.530385	−0.015921

$\tan f_1$	0.004599
$\tan f_2$	0.004576
μ'	0.261800 radians per hour
d'	−0.000091 radians per hour

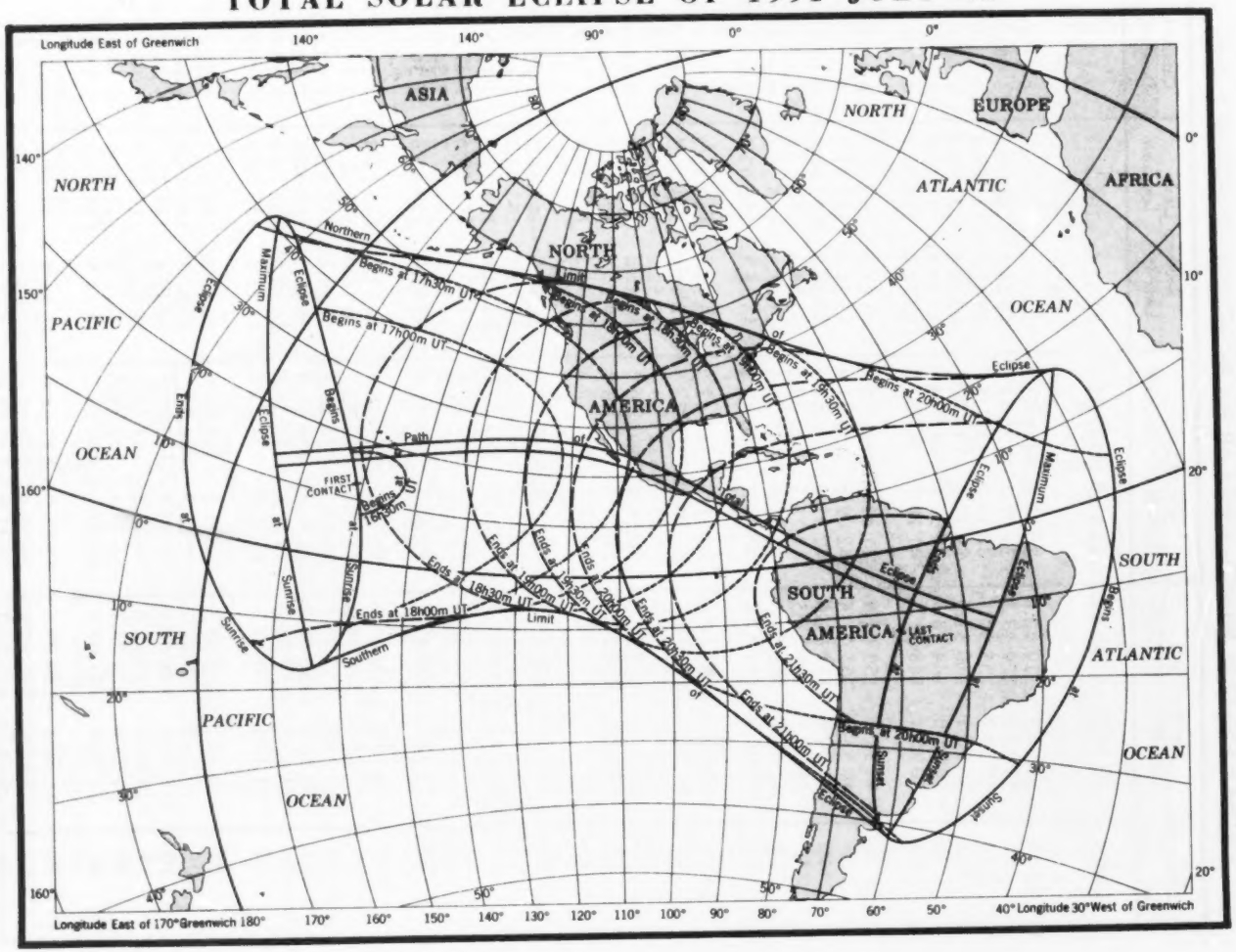
ANNULAR SOLAR ECLIPSE OF 1991 JANUARY 15-16



PATH OF CENTRAL PHASE: ANNULAR SOLAR ECLIPSE OF JANUARY 15-16

U.T.	Northern Limit Latitude	Northern Limit Longitude	Central Line Latitude	Central Line Longitude	Southern Limit Latitude	Southern Limit Longitude	Central Line Duration	Central Line Alt.
	° ′	° ′	° ′	° ′	° ′	° ′	m s	°
Limits	−28 30.7	+110 37.5	−29 51.9	+109 35.8	−31 13.6	+108 31.7	5 34.8	–
h m								
22 00	−31 54.3	+119 20.8	−30 50.0	+112 03.3	-----	-----	5 38.4	2
05	35 22.2	129 17.2	36 08.3	126 42.0	−36 45.8	+123 37.0	6 03.5	17
10	37 13.9	135 32.1	38 14.2	133 38.2	39 11.7	131 29.4	6 17.3	23
15	38 30.1	140 31.5	39 37.1	139 00.5	40 42.9	137 19.2	6 28.7	29
20	39 25.0	144 48.9	40 36.1	143 34.5	41 46.6	142 12.0	6 38.7	33
25	40 05.1	148 38.6	41 18.7	147 37.5	42 32.3	146 29.8	6 47.8	37
22 30	−40 33.8	+152 07.9	−41 49.0	+151 18.2	−43 04.5	+150 23.1	6 56.1	41
35	40 53.2	155 21.4	42 09.5	154 41.8	43 26.2	153 57.7	7 03.7	44
40	41 04.8	158 22.0	42 21.6	157 51.5	43 39.1	157 17.4	7 10.7	47
45	41 09.7	161 11.5	42 26.7	160 49.4	43 44.4	160 24.4	7 17.0	50
50	41 08.7	163 51.6	42 25.6	163 37.3	43 43.3	163 20.6	7 22.8	53
55	41 02.4	166 23.4	42 18.9	166 16.2	43 36.3	166 07.2	7 28.1	56
23 00	−40 51.3	+168 47.6	−42 07.3	+168 47.0	−43 24.1	+168 45.2	7 32.7	58
10	40 16.5	173 16.3	41 30.8	173 27.6	42 46.0	173 38.5	7 40.3	63
20	39 26.8	+177 22.2	40 39.0	+177 43.7	41 52.0	+178 05.4	7 45.5	67
30	38 24.2	−178 51.2	39 34.0	−178 20.9	40 44.4	−177 50.0	7 48.6	70
40	37 10.0	175 20.9	38 17.1	174 43.2	39 24.8	174 04.5	7 49.4	73
50	35 45.3	172 04.2	36 49.7	171 20.1	37 54.5	170 34.9	7 48.2	74
0 00	−34 10.7	−168 58.6	−35 12.3	−168 09.0	−36 14.3	−167 18.1	7 45.1	74
05	33 19.9	167 29.1	34 20.0	166 37.1	35 20.6	165 43.7	7 42.9	73
10	32 26.7	166 01.3	33 25.5	165 07.0	34 24.6	164 11.3	7 40.3	72
15	31 31.1	164 35.0	32 28.6	163 38.6	33 26.4	162 40.6	7 37.3	71
20	30 33.2	163 09.8	31 29.4	162 11.3	32 25.9	161 11.2	7 34.0	69
25	29 32.9	161 45.2	30 27.8	160 44.8	31 23.0	159 42.6	7 30.3	67
0 30	−28 30.2	−160 21.0	−29 23.8	−159 18.6	−30 17.7	−158 14.4	7 26.3	65
35	27 24.9	158 56.5	28 17.3	157 52.2	29 10.0	156 46.1	7 21.9	63
40	26 17.0	157 31.4	27 08.2	156 25.2	27 59.6	155 17.1	7 17.4	61
45	25 06.3	156 05.0	25 56.3	154 56.8	26 46.5	153 46.8	7 12.5	59
50	23 52.6	154 36.8	24 41.4	153 26.6	25 30.5	152 14.4	7 07.4	56
55	22 35.6	153 05.8	23 23.3	151 53.5	24 11.2	150 39.0	7 02.0	53
1 00	−21 15.1	−151 31.3	−22 01.6	−150 16.6	−22 48.3	−148 59.7	6 56.3	51
05	19 50.5	149 52.0	20 35.9	148 34.7	21 21.3	147 14.9	6 50.4	48
10	18 21.4	148 06.5	19 05.5	146 46.1	19 49.6	145 23.1	6 44.2	45
15	16 46.8	146 12.8	17 29.6	144 48.8	18 12.2	143 21.9	6 37.7	41
20	15 05.8	144 08.1	15 46.9	142 39.7	16 27.9	141 07.9	6 30.8	38
25	13 16.5	141 48.3	13 55.7	140 14.2	14 34.5	138 35.9	6 23.5	34
1 30	−11 16.4	−139 07.1	−11 53.0	−137 24.8	−12 28.7	−135 37.1	6 15.6	30
35	9 00.5	135 52.4	9 32.8	133 57.4	10 03.5	131 54.3	6 06.8	24
40	6 18.1	131 38.2	6 41.8	129 17.9	7 00.7	126 40.8	5 56.3	18
45	− 2 30.9	124 49.3	− 2 13.5	120 38.1	-----	-----	5 40.5	7
Limits	+ 1 49.8	−115 08.3	+ 0 27.4	−114 17.3	− 0 55.7	−113 25.2	5 31.2	–

TOTAL SOLAR ECLIPSE OF 1991 JULY 11



PATH OF CENTRAL PHASE: TOTAL SOLAR ECLIPSE OF JULY 11

U.T.	Northern Limit Latitude	Northern Limit Longitude	Central Line Latitude	Central Line Longitude	Southern Limit Latitude	Southern Limit Longitude	Central Line Duration	Central Line Alt.
	° ′	° ′	° ′	° ′	° ′	° ′	m s	°
Limits	+13 18.8	−175 02.0	+12 28.7	−174 36.2	+11 38.5	−174 11.0	3 14.0	–
h m								
17 25	+16 57.0	−166 05.4	+16 22.4	−164 51.8	+15 43.6	−163 48.2	3 40.9	11
30	+20 29.7	−156 36.4	+19 40.0	−155 51.6	+18 48.7	−155 11.1	4 10.7	21
35	22 25.8	150 43.8	21 30.6	150 08.2	20 34.4	149 35.9	4 32.0	28
40	23 46.0	146 05.8	22 47.3	145 36.3	21 47.8	145 09.7	4 50.1	33
45	24 44.9	142 08.9	23 43.6	141 44.5	22 41.7	141 22.6	5 06.2	38
50	25 28.9	138 38.9	24 25.5	138 19.1	23 21.7	138 01.5	5 20.9	42
55	26 01.5	135 28.3	24 56.4	135 12.8	23 51.1	134 59.2	5 34.3	46
18 00	+26 24.8	−132 32.6	+25 18.4	−132 21.1	+24 11.9	−132 11.4	5 46.6	50
05	26 40.2	129 48.7	25 32.9	129 41.1	24 25.4	129 35.1	5 57.9	54
10	26 48.8	127 14.5	25 40.7	127 10.7	24 32.6	127 08.3	6 08.2	57
15	26 51.4	124 48.4	25 42.8	124 48.4	24 34.2	124 49.4	6 17.6	60
20	26 48.6	122 29.5	25 39.6	122 33.0	24 30.7	122 37.4	6 25.9	63
25	26 40.7	120 16.6	25 31.7	120 23.5	24 22.6	120 31.2	6 33.4	66
18 30	+26 28.3	−118 09.1	+25 19.3	−118 19.4	+24 10.3	−118 30.1	6 39.8	69
35	26 11.6	116 06.3	25 02.8	116 19.8	23 53.9	116 33.6	6 45.3	72
40	25 50.9	114 07.8	24 42.4	114 24.3	23 33.9	114 40.9	6 49.8	75
45	25 26.4	112 13.0	24 18.3	112 32.4	23 10.3	112 51.8	6 53.4	78
50	24 58.2	110 21.6	23 50.7	110 43.7	22 43.2	111 05.7	6 55.9	81
55	24 26.5	108 33.1	23 19.7	108 57.8	22 12.9	109 22.3	6 57.5	84
19 00	+23 51.5	−106 47.2	+22 45.5	−107 14.3	+21 39.4	−107 41.1	6 58.1	87
05	23 13.1	105 03.5	22 08.0	105 32.9	21 02.7	106 01.9	6 57.8	89
10	22 31.6	103 21.6	21 27.4	103 53.2	20 23.0	104 24.2	6 56.6	88
15	21 46.8	101 41.3	20 43.6	102 14.8	19 40.2	102 47.8	6 54.5	85
20	20 58.9	100 02.1	19 56.7	100 37.5	18 54.4	101 12.2	6 51.5	82
25	20 07.8	98 23.6	19 06.7	99 00.7	18 05.4	99 37.0	6 47.7	79
19 30	+19 13.5	− 96 45.4	+18 13.6	− 97 24.1	+17 13.4	− 98 01.9	6 43.0	77
35	18 15.9	95 07.1	17 17.2	95 47.3	16 18.1	96 26.5	6 37.6	74
40	17 14.9	93 28.2	16 17.4	94 09.7	15 19.4	94 50.2	6 31.4	71
45	16 10.4	91 48.1	15 14.1	92 30.7	14 17.3	93 12.4	6 24.4	68
50	15 02.2	90 06.1	14 07.1	90 49.9	13 11.5	91 32.7	6 16.8	65
55	13 50.0	88 21.4	12 56.1	89 06.3	12 01.8	89 50.0	6 08.4	62
20 00	+12 33.4	− 86 33.2	+11 40.9	− 87 19.0	+10 47.8	− 88 03.7	5 59.4	58
05	11 12.1	84 40.2	10 20.8	85 26.9	9 29.0	86 12.5	5 49.6	55
10	9 45.3	82 41.0	8 55.4	83 28.6	8 04.9	84 15.0	5 39.1	52
15	8 12.4	80 33.6	7 23.9	81 22.1	6 34.6	82 09.3	5 27.9	48
20	6 32.0	78 15.3	5 45.0	79 04.7	4 57.1	79 52.8	5 15.8	44
25	4 42.5	75 42.2	3 57.1	76 32.6	3 10.7	77 21.6	5 02.8	40
20 30	+ 2 41.1	− 72 48.0	+ 1 57.5	− 73 39.8	+ 1 12.8	− 74 29.9	4 48.7	35
35	+ 0 23.2	69 21.9	− 0 18.3	70 15.6	− 1 01.0	71 07.4	4 32.9	30
40	− 2 21.2	65 01.3	2 59.7	65 58.5	3 39.7	66 53.3	4 14.8	24
45	6 01.1	58 38.4	6 33.4	59 45.5	7 08.0	60 48.5	3 51.9	16
Limits	−12 08.5	− 45 46.7	−12 58.4	− 46 12.2	−13 48.2	− 46 37.4	3 13.2	–

The Astronomical Almanac is issued annually by H. M. Nautical Almanac Office, Royal Greenwich Observatory, and the Nautical Almanac Office, U. S. Naval Observatory. Included in this volume are ephemerides of the Sun, Moon, planets and their natural satellites, as well as data on eclipses and other astronomical phenomena. The data in this volume are calculated cooperatively by the British and American offices, with contributions from the Bureau des Longitudes and the Astronomisches Rechen-Institut.

Apparent Places of Fundamental Stars is issued annually by the Astronomisches Rechen-Institut. Positions of 1535 stars of the *Fourth Fundamental Catalogue* (*FK4*) are given at 10-day intervals. This volume is available from Verlag G. Braun, Karlsruhe.

Planetary and Lunar Coordinates, 1984–2000, is issued by H. M. Nautical Almanac Office, Royal Greenwich Observatory, with the cooperation of the Nautical Almanac Office, U. S. Naval Observatory. The volume provides low precision astronomical data for planning purposes in advance of the annual ephemerides. Included are heliocentric and geocentric ephemerides of the Moon and planets, information on the observability of the Moon and planets, eclipse data, and auxiliary data, such as orbital elements and precessional constants. The previous volume of this series covers the interval 1980–1984.

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Ephemerides of Minor Planets is issued annually by the Institute for Theoretical Astronomy, Academy of Sciences of the U.S.S.R. Included in this volume are elements, opposition dates and opposition ephemerides of all numbered minor planets. This volume is available from the Institute for Theoretical Astronomy, Leningrad.

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*U.S. Government Printing Office: 1989-194-282/00462